

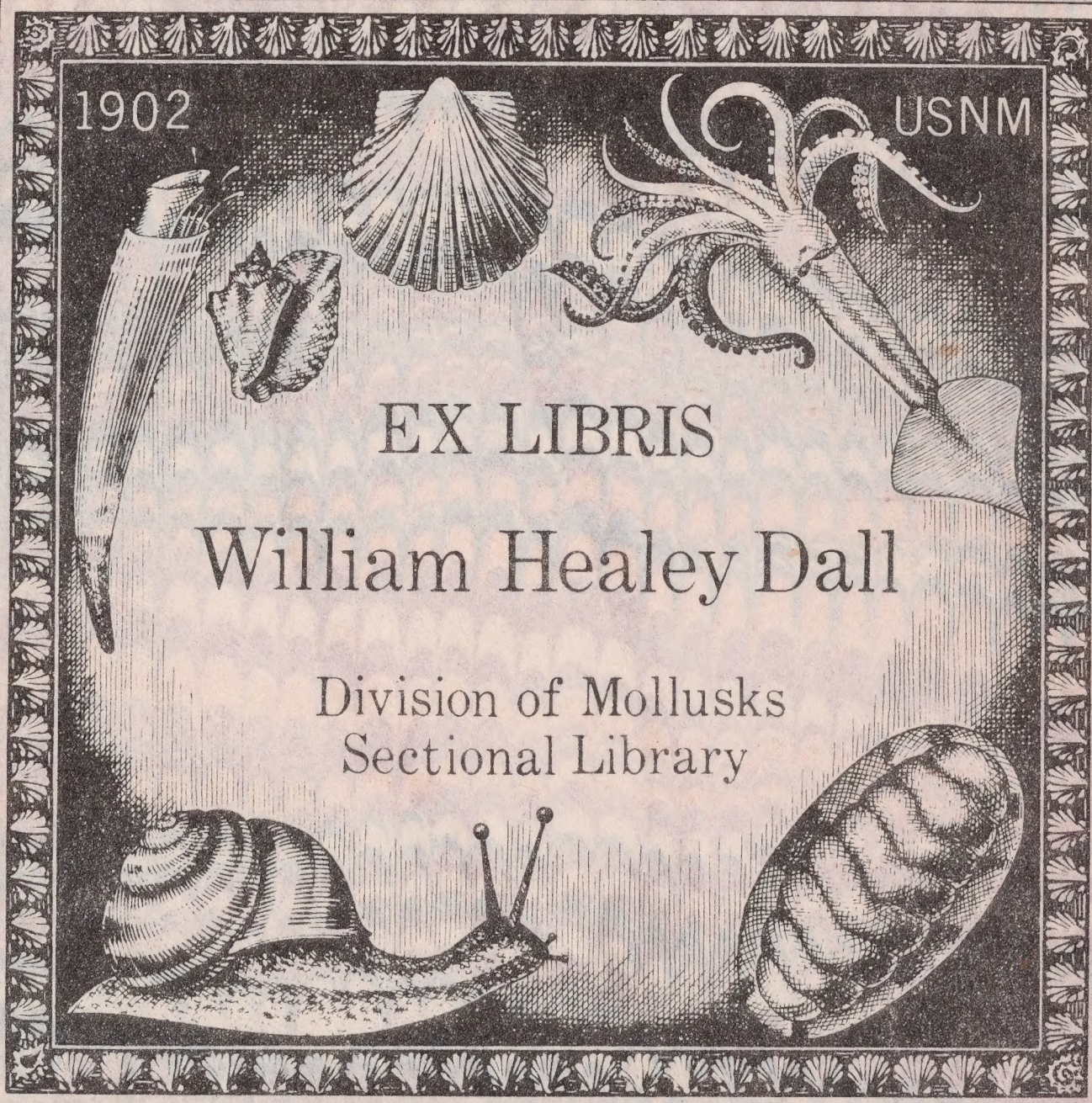
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THE

JOURNAL OF CONCHOLOGY:

(Founded 1874)

BEING THE ORGAN OF THE
CONCHOLOGICAL SOCIETY
OF GREAT BRITAIN AND IRELAND

EDITED, UNDER THE DIRECTION OF THE COUNCIL,

BY

J. R. LE B. TOMLIN, M.A., F.R.E.S.

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VOL. XX.

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NEW NAMES PROPOSED IN THIS VOLUME.

	<i>page</i>
<i>Goniodoris ovata</i> Barnard	2
<i>Limapontia depressa</i> (A. & H.) var. <i>pellucida</i> Kevan	18
<i>Lucina odontotis</i> Salisbury	58
<i>Melanopsis doriæ</i> Issel var. <i>nigra</i> Biggs	60
<i>Hyridella bardwelli</i> Clench	89
<i>Albinaria greeni</i> Tomlin	164
<i>Berthellina engeli</i> Gardiner, n.g. & sp.	198
<i>Macrocallista</i> (<i>Paradione</i>) <i>bardwelli</i> Clench and McLean	201
<i>Edentulina ulugurensis</i> Bequaert and Clench	213
<i>Edentulina usambarensis</i> Bequaert and Clench	215
<i>Armenica</i> (<i>Creniclavis</i>) <i>euprepes</i> Biggs	253
<i>Conus hopwoodi</i> Tomlin	254
<i>Aglaja iwasai</i> Hirase	258
<i>Gonaxis</i> (<i>Macrogonaxis</i>) <i>loveridgei</i> Bequaert and Clench	271
<i>Monacha iranica</i> Biggs	343
<i>Helicella millepunctata</i> Bttg. var. <i>depressa</i> Biggs	344
" " " var. <i>castaneoradiata</i> Biggs	344
" " " var. <i>hyalopunctata</i> Biggs	344
<i>Melanopsis doriæ</i> Issel var. <i>fasciata</i> Biggs	348
" " " var. <i>carinata</i> Biggs	348
<i>Theodoxus doriæ</i> Issel var. <i>obscura</i> Biggs	349

Vol. 20]

18TH MAY, 1934.

[No. 1

... THE ...
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CONTENTS.

	PAGE
List of Officers and Council ..	I
A New Species of <i>Goniodoris</i> from South Africa (with figures)—DR. BARNARD.	2
Oldhaven and Thanet Sand Moll. of Herne Bay (Presidential Address)—J. E. COOPER ..	4
Names of British Mollusca. II.—R. WINCKWORTH ..	9
<i>Limapontia depressa</i> (A. & H.) var. nov. in Scotland (with map)—D. K. KEVAN ..	16
Habitat of <i>Facelina drummondi</i> (A. & H.)—MISS N. FISHER ..	24
Proceedings: 7th Oct. (Annual Meeting), 11th Nov., 9th Dec., 1933; 13th Jan., 1934 ..	25
Accounts ..	30

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By R. WINCKWORTH, M.A.

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THE
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VOL. 20.

18th MAY, 1934.

No. 1.

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A NEW SPECIES OF GONIODORIS FROM SOUTH AFRICA.

BY K. H. BARNARD, D.Sc., F.L.S. (South African Museum, Cape Town).

(Read before the Society, 16th September, 1933.)

ONLY a single representative of the family Okeniidæ (*olim* Goniodorididæ) has hitherto been known from South Africa, viz. *Idaliella amoenula* Bgh. In June, 1933, while examining the bottom of the training ship *General Botha* in Simonstown dry-dock, I found two nudibranchs which appeared to belong to the genus *Goniodoris*. The ship had been moored in Simon's Bay for three and a half years.

The specimens were 20–21 mm. long and 11–12 mm. broad. The colour was orange-buff, with the dark bluish internal organs showing through on the back and right side; the gills, clubs of the rhinophores and some of the tubercles darker brownish.

The shape of the body is much more broadly oval than the figures of *G. nodosa* (Mont.) and *G. castanea* A. & H. (Alder & Hancock, *Brit. Nudibr. Moll.*, pls. 18, 19; Garstang, *J. Mar. Biol. Assoc.*, i, pl. 27, 1890; Baba, *Venus*, ii, pl. 2, fig. 3, 1930) or even Vayssière's figure of *castanea* (*Ann. Mus. Marseille*, vi, pl. 1, fig. 9, 1901).

In other respects the external characters are typical. The head tentacles are blunt, digitiform, with a slight, somewhat nodose ridge on upper surface; the free edge of the mantle slightly undulate (in one specimen feebly scalloped), continuous in front of the rhinophores but interrupted behind the gills, and not continuous with the ridge on the tail; a slight medio-dorsal keel. Back elevated and smooth, but the sides with fairly numerous small tubercles. Gills nine, not quite symmetrical, tripinnate, some of them bifurcate distally; the hindermost two are shorter, more papilliform, with stout axis and less exsert pinnæ. Cuticular spicules feebly nodulose.

Internal anatomy in general corresponding with Alder & Hancock's account (loc. cit., pl. 17, fig. 1). Suctorial crop (ingluvies) completely sessile on the buccal sac. No labial armature. Radula consisting of fourteen pairs of large hamate teeth, rachis naked, no small plate-like laterals, formula 0.1.0.1.0.; the apices of the teeth have a slight ridge, but no denticles.

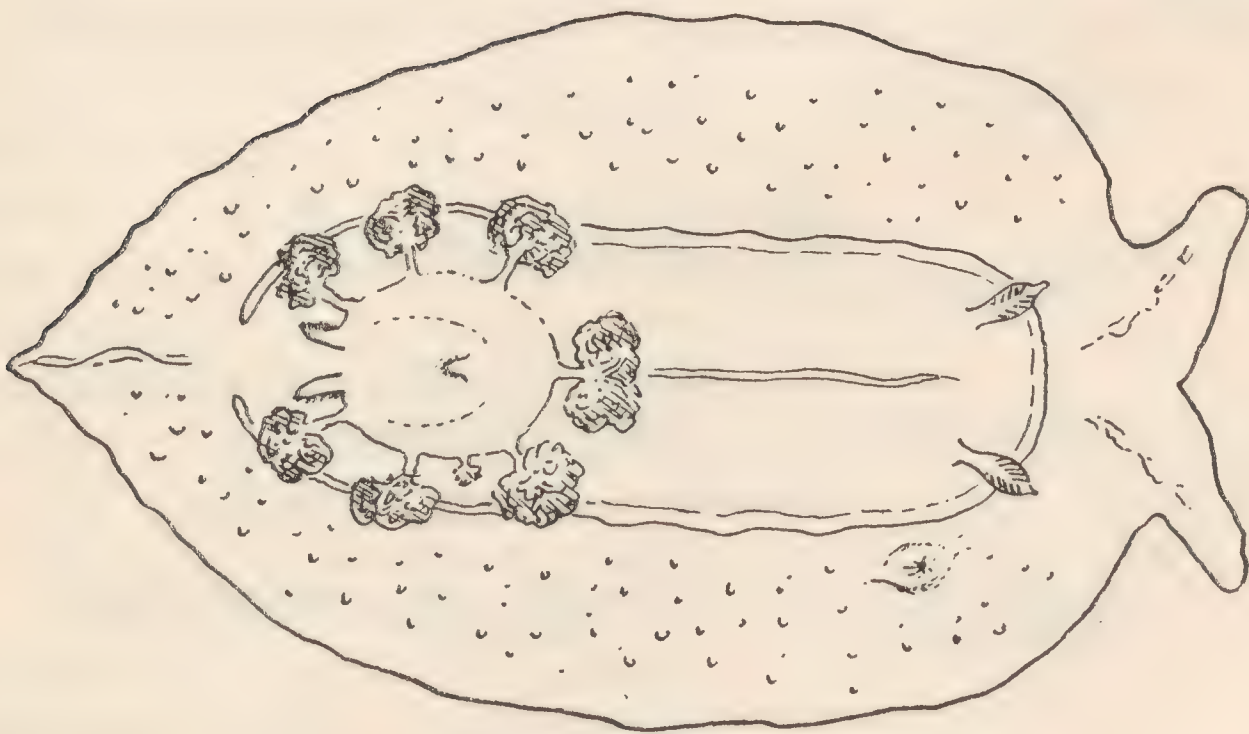
From the typical species of *Goniodoris* this form differs in the tripinnate gills, and the absence of labial armature and outer lateral teeth on the radula; the ingluvies has not even a short petiole.

Nevertheless, it is so obviously a "Goniodoris" that I propose to include it in this genus under the name *Goniodoris ovata* n.sp.

Risbec's species *G. joubini* and *G. violacea* from New Caledonia (*Faune Col. Franç.*, ii, 1928) are quite different.



Goniodoris ovata n.sp. radula tooth.



— n. s. —

Goniodoris ovata n.sp.

OLDHAVEN AND THANET SAND MOLLUSCA OF HERNE BAY.

(Presidential Address delivered at the Annual Meeting, 7th October, 1933.)

By J. E. COOPER.

To the geologist the north-east coast of Kent is of great interest, and the small piece between Herne Bay and Reculver is especially worthy of study as it contains the classic section of the Oldhaven beds.

Geologizing on our coast is not without incidents. Any one who has put his foot into a London Clay "mud-glacier"—they abound in the winter—will not do it again in a hurry.

After heavy weather the beach is sometimes well scoured, and one may possibly spot the butt-end of a Mammoth tusk in the "clay-with-flints". Then follows a race home for a spade, followed by some strenuous digging so as to forestall the rising tide. With luck the tusk is excavated, and having been hidden under some bushes for the night, is brought home next morning precariously balanced on a bike.

Oldhaven Gap, now called Bishopstone Glen, is a ravine in the cliffs about midway between Herne Bay and Reculver. The section now shortly described is a little west of Bishopstone Glen. The cliff here is about 100 feet high.

SECTION 200 YDS. WEST OF BISHOPSTONE GLEN (OLDHAVEN GAP).

PLEISTOCENE	Gravel, abt. 5'.
EOCENE	Blue Clay, abt. 40'.
London Clay	
Oldhaven	Buff and greyish Sand, abt. 25'. (Many Mollusca.)
	—————Black Pebble band.
Landenian " Woolwich "	Light grey and greenish Sand, abt. 26'.
O.D.	—————O.D.
	Foreshore.
Thanet.	Sandy Clay (with Mollusca).

PLEISTOCENE.

The top stratum is a few feet of gravel.

EOCENE.

About 40 feet of London Clay, then some 25 feet of Oldhaven beds, with a band of black pebbles at the base; next come 25 feet of sand, which represent the Woolwich beds. As this bed is marine

and cannot be satisfactorily separated from the underlying Thanet series, it seems best to adopt Wooldridge's suggestion¹ and call the whole Landenian. The sandy clay of the Thanet Sand comes out on the foreshore.

OLDHAVEN BEDS.—These contain numerous mollusca. Thin irregular bands of shells (mostly *Cyprina morrisii*) run through the loose sand. Near the base is a fairly constant thick band of shelly limestone, sometimes hard, sometimes rotten, occasionally passing into loose sand.

Most of the species listed below came from close to this section, the rest were obtained from a spot about one-third of a mile to the east.

Nucula proava S. V. Wood. Scarce.

N. fragilis (Desh.). Rather common.

N. sextans S. V. Wood. Scarce.

N. striatella S. V. Wood. A few only.

N. cf. prælævigata S. V. Wood. Two odd valves.

Nucula sp. This bears some resemblance to *N. proava*, but differs in shape and it has very strong hinge-teeth. It does not seem to fit any described species.

Glycymeris terebratularis (L.). A few.

G. plumsteadiensis (J. Sow.). A few.

Modiola simplex J. Sow. Scarce; a very frail shell.

M. cf. depressa J. Sow. One example.

Mytilus (*Arcomytilus*). ? n.sp. One only.

Astarte elevata G. B. Sow. Not uncommon.

Cyprina morrisii J. Sow. Very common and very variable.

Trapezium n.sp. A few valves.

Dosiniopsis bellovacensis (Desh.). Common.

Protocardium plumsteadianum (J. Sow.), including *P. laytoni* Morris.

The small form (*laytoni*) is abundant; when in good condition it has a smooth creamy surface. The thicker and larger form (*plumsteadianum*) is much less common.

Corbula morrisii Edw. MS. Common.

C. regulbiensis Morris. Also common.

Panopæa intermedia J. Sow. A few.

Cyrtodaria rutupiensis (Morris). A few.

Pteria media (J. Sow.). One small example.

Calyptræa suessoniensis (Orb.). Scarce.

Ficus nodulifera (G. B. Sow.). Not uncommon. It seems to occur in small colonies.

¹ *Proc. Geol. Assoc.*, xxxvi, p. 3, Oct., 1925. Since the above was read Mr. A. G. Davis has told me that the name "Bishopstone" has been proposed for the "Woolwich" marine beds of East Kent.

Ficus sp. A single specimen, which appears to differ from any of the species described in *Proc. Malac. Soc.*, xviii, p. 235.

Natica (*Polynices*) *abducta* (Desh.). Common.

„ „ *repanda* (Desh.). Common.

N. (*Euspira*) *glaucinoïdes* J. Sow. Common.

Natica sp. A few of a remarkably high-spined form, not identified.

Ampullina sp. One example.

Odostomia cf. *regularis* Edw. MS. Rare.

Aporrhais sowerbyi Mantell. Common.

A. margerini S. Gardner (*non* de Kon.). A few.

Siphonalia mariæ (Melleville). Not uncommon and very variable ; one specimen of the large form with less prominent knobs, which has been found at Swanscombe Hill.

“*Buccinum*” *concinnum* G. B. Sow. (*Q. J. G. S.*, 1859, p. 136).

Several specimens. The genus of this shell is uncertain, as the characters of the aperture are as yet unknown.

Hemipleurotoma infraeocænica Cossm. Fairly common.

H. cf. *laubrierei* Cossm. With the last.

cf. *Parvisipho* sp. A pretty little shell found with the last two.

Besides mollusca, the Oldhaven Beds contain sharks' teeth of at least three species ; scales, spines, and vertebræ of fish, also bones of a small Chelonian.

In clay intercalations amber-coloured crystals of gypsum are found.

LANDENIAN.—In this section the upper part (“Woolwich”) has no mollusca.

CORBULA BED.—Some 26 feet below the pebble band of the Oldhaven Beds there is a scattered line of “pockets” formed of slightly hardened sand, full of *C. regulbiensis*. This bed is first seen a little west of Bishopstone Glen. It can be traced in the cliff nearly as far as Reculver. It contains :—

Nucula fragilis (Desh.). Scarce.

Glycymeris plumsteadensis (J. Sow.). Scarce.

G. terebratularis (L.). Rare.

Cyprina morrisii J. Sow. A few.

C. scutellaria Lam. Fragments.

Dosiniopsis bellovacensis (Desh.). A few.

Protocardium plumsteadianum (J. Sow.). The small form [= *laytoni* (Morris)] occurs occasionally.

Protocardium sp. A scarce form, which attains the size of *plumsteadianum*, but differs from that species by having about fifteen sharply tubercled ribs on the posterior fifth of the shell.

Corbula regulbiensis Morris. In vast quantities. Many specimens have an accessory rostral plate. This was first noted by a Belgian student, the late E. Vincent.

Cyrtodaria rutupiensis (Morris). A few.

Panopæa intermedia J. Sow. A few.

P. granulata Morris. Scarce.

Sanguinolaria edwardsi Morris. Scarce.

Thracia oblata J. Sow. Very rare.

Cucullæa decussata Park. The typical form is scarce. Most of the specimens found are smaller than the Thanet Sand form and are almost square in outline.

Ostrea bellovacina Desh. Rare.

Calyptræa suessoniensis (Orb.). Rare.

Ficus intermedia (Melleville). Scarce.

Natica (*Polynices*) *abducta* (Desh.). A few.

„ „ *repanda* (Desh.). Frequent.

N. (Euspira) glaucinoides J. Sow. Frequent.

N. cf. (Lunatia) viviparoides Cossm. Rare. This is near the high-spired Oldhaven species noted above.

Aporrhais sowerbyi Mant. A few.

Epitonium bowerbanki (Morris). Very rare.

Siphonalia mariæ (Mellev.). Scarce. Much smaller than the Oldhaven form and more highly sculptured.

Cominella bicoronata (Mellev.). Very rare.

Hemipleurotoma cf. infraeocænica Cossm. Very rare.

Tornatellæa parisiensis (Desh.). Very rare.

Entaliopsis brevis (Desh.). Frequent.

The *Corbula* band shells are mostly silicified, but sometimes there occur hard flinty lumps in which the shells of the *Corbula* have perished, leaving perfect casts of the exteriors.

As a rule the shells of the *Corbula* are perfect, while those of the associated species are crushed and broken. The inference is that the *Corbula* lived on the spot, while the others were "dead" shells that were drifted into the pockets.

On the same horizon one occasionally finds internal casts of a large *Cyprina* (probably *C. scutellaria*). No trace of the shell remains, and the hardened sand adheres to the smooth surface of the cast. This suggests that the *Cyprina* were already casts when deposited in the sand.

In this stratum wood is common, mostly silicified, the rest as lignite. Pieces of the former are often riddled with the borings of *Teredo antenautæ* J. Sow., varying from 3 mm. to 10 mm. in diameter.

Probably *Teredina personata* Lam. is also present, but the actual shell has yet to be found.

THANET SAND.—At Bishopstone a few feet of barren sand underlie the *Corbula* bed. Below this is a bed of greenish sandy clay with innumerable *Cyprina*. This stratum is sometimes well exposed on the shore. It contains :—

- Nucula fragilis* Desh. Scarce.
Glycymeris terebratularis (L.). A few.
G. plumsteadiensis (J. Sow.). Scarce.
Astarte tenera J. Sow. A few.
Cyprina morrisii J. Sow. In profusion, and showing great variation.
C. scutellaria Lam. Much less common.
Dosiniopsis bellovacensis (Desh.). Common.
Corbula regulbiensis Morris. Common in the top of the bed.
C. morrisii Edw. MS. Scarce, with the last.
Panopæa granulata Morris. A few.
P. intermedia J. Sow. A few.
Cyrtodaria rutupiensis (Morris). Frequent.
Sanguinolaria edwardsi Morris. A few.
Thracia oblata J. Sow. Common.
Pecten contubernalis S. V. Wood. Rare.
Cucullæa decussata Park. Common.
Ostrea bellovacina Desh. Frequent, but only in the upper part of the bed. Large examples exceed 4 inches in diameter. Small specimens are found attached to pieces of pyritized wood. If, as sometimes happens, the convex valve is attached, the oyster had a decidedly thin time, as both valves became nearly flat. *O. cymbuloides* S. V. Wood appears to be merely a young shell of this species with more ribs than usual.
Pholadomya cuneata J. Sow. A few.
P. konincki Nyst. A few.
Teredo antenautæ J. Sow. and *Teredina personata* Lam. Are probably both represented, as "Teredo" tubes are abundant in pyritized wood.
Natica (Polynices) abducta (Desh.). Frequent.
Aporrhais sowerbyi Mantell. Scarce.
Cominella desori Desh. One example.

A few other species have been seen, but in too poor condition to identify.

Gasteropoda are decidedly scarce in the Thanet Sand, yet large numbers of the Pelecypoda are found bored, a curious fact which needs explanation.

The foregoing lists are far from complete, they merely give the results of the writer's collecting.

In conclusion, I would express my cordial thanks to Mr. Arthur G. Wrigley for useful collecting hints and for much assistance in identifying the shells; to Mr. L. R. Cox for help with names and for allowing me to consult the British Museum collections; and to Dr. E. I. White for kindly identifying the sharks' teeth.

NAMES OF BRITISH MOLLUSCA.—II.

By R. WINCKWORTH, M.A.

(Read before the Society 9th December, 1933.)

I AM indebted to Mr. A. Wrigley for drawing my attention to four of the five following corrections to the List of British Marine Mollusca in Part 7 of this volume :—

p. 228. For CASSIDARIA Lamarck 1816

read GALEODEA Link 1807.

p. 243, no. 85. To the references add (*cor*).

p. 244, no. 94. To the references add (*norvegicum*).

p. 244, no. 101. For ovata (Pennant 1777)

read ovata Pennant 1777.

p. 244, no. 106. For 332 read 382.

The first correction requires comment. *Galeodea* Link is often quoted with the assertion that it is preoccupied by Olivier for a genus of beetles. Unfortunately this is one of the very few names I took for granted and did not check. I have since looked up the alleged *Galeodea* of Olivier and find that it does not exist : the coleopterous genus is *Galeodes*.¹ *Galeodea* Link is therefore available for the molluscan genus, and has the same type species as the later *Cassidaria*.

ARCA LACTEA Linné (p. 239).

Mr. Wrigley also disagrees with my placing of *Arca lactea* in the subgenus *Barbatia*. I agree with him in regarding it as a *Fossularca* ; but I had adopted Dall's view that *Calloarca*, *Granoarca*, *Striarca*, *Acar*, *Fossularca*, etc., are only sections of the subgenus *Barbatia*, which "merge into one another through their peripheral species".² In *Fossularca* the lozenge occupied by the ligament is small and leaves part of the cardinal area uncovered on both sides, in *Acar* only the anterior part of this area is bare, and in *Striarca* the entire cardinal area is covered by the ligament. However, the recent species of *Fossularca* form a distinctive section, which, as Lamy³ has pointed out, is also characterized by a peculiar sculpture, so that perhaps it is desirable to separate them. The name *Fossularca*, however, is not to be used as (here again I am indebted to Mr. Wrigley for information) there are two earlier synonyms, namely *Arcopsis* von Koenen 1884⁴ and *Trigonodesma*

¹ *Encyc. Méth.*, tome sixième (Insectes), p. 579 (1791).

² "Tertiary Fauna of Florida," *Trans. Wagner Free Inst. Sci.*, vol. 3, p. 615 (1898).

³ *J. Conchyl.*, vol. 55, p. 4 (1907).

⁴ *Paleocene Kopenhagen*, p. 86.

S. V. Wood 1864,¹ of which the genotype is the Eocene species *Arca lissa* Bayan = *A. lævigata* Cuillat, *non* Spengler. In accordance with this point of view *Arca lactea* should be placed in:—

S.G. TRIGONODESMA Wood 1864. *A. lissa* Bayan.

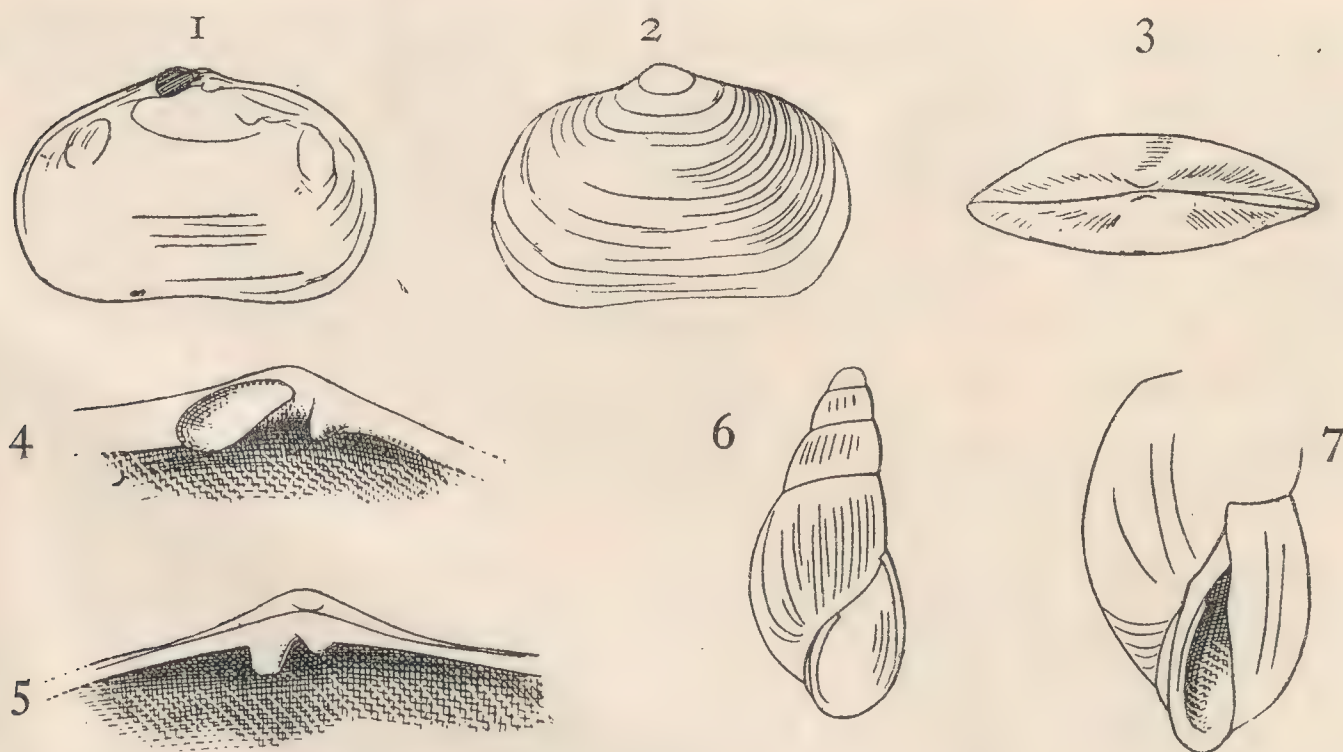
DORIDIGITATA STICTA Iredale & O'Donoghue (p. 235).

This is the species originally described by Garstang² as *Doris maculata*, and in omitting it from the list, I was influenced by Eliot's suggestion³ that it might be an extreme variation of *Doridigitata derelicta* (Fischer), i.e. *Doris verrucosa* of Eliot and others. I have had opportunity of comparing the animal with the excellent figures given by Eliot (loc. cit., pl. 8), and I now believe this was a serious error of omission, so that the following addition must be made on p. 235, after no. 315:—

sticta Iredale & O'Donoghue 1923.

MONTACUTA PHASCOLIONIS Dautzenberg & Fischer (p. 243).

I find that I gave no reference for this interesting little bivalve, which may well prove to occur in British waters as a commensal with *Phascolion strombi* (Montagu); this gephyrean is commonly found in the shells of *Aporrhais*, *Turritella*, *Dentalium*, etc., and may easily be recognized by its habit of filling the mouth of the shell it lives in with a cement of sand grains. A third associate of the group is *Odostomia perezii* (D. & F.). These two molluscs were



FIGS. 1-3: *Montacuta phascolionis* D. & F., shell, $\times 6$.

FIGS. 4, 5: *Montacuta phascolionis* D. & F., hinge, $\times 15$ approx.

FIG. 6: *Odostomia perezii* (D. & F.), shell, $\times 8$.

FIG. 7: *Odostomia perezii* (D. & F.), detail of mouth, $\times 12$ approx.

¹ *Eocene Bivalves*, p. 86.

² *J. Mar. Biol. Assoc.*, vol. 4, p. 167 (1896).

³ *Ray Society Monograph for 1919*, p. 99 (1910).

described in an interesting account of "Les Mollusques marins du Finistère",¹ which I commend to the notice of English conchologists, and which should be consulted for the descriptions of these two species (pp. 81 and 126). I have to thank M. Ph. Dautzenberg for readily giving me permission to reproduce the original figures.

MACTRA GLAUCA Born (p. 246).

I have marked this species in the list as Sarnian only, in spite of its recorded occurrence in Cornwall, for I can find no evidence that it occurs living to-day in British seas north of the Channel Islands. I imagine, though positive proof is lacking, that the Cornish examples are derived from a Holocene or Pleistocene bed below low water, from which numerous valves were at one time washed ashore. "Almost all the British examples consist of the worn valves which were obtained by Miss Pocock (1801) from the sands of Hale in Cornwall."² There are also records of one valve from Padstow and fragments at Lands End. A single valve was found on the sands at Hayle by Cocks in 1846, according to a MS. note in my copy of Jonathan Couch's *Cornish Fauna*. I can find no later records in textbooks or local lists.³

Most of the following notes on genera are stimulated by comments in a review of my list in the Japanese journal *Venus*.⁴

ACMÆA v. PATELLOIDA (p. 219).

Acmæa admittedly has one year's priority over *Patelloida*, but it seems to me that since *æ* and *e* are variants of the same letter in Latin,⁵ *Acmæa* 1833 is preoccupied by *Acmea* 1821; both names are presumably derived from ἀκμῆ, and Hartmann's genus of 1821 was emended to *Acmaea* by Agassiz. Unfortunately a loophole for argument is left, in that, while the point is settled for specific names in article 35 of the International Rules, where it is laid down that "specific names . . . shall be considered homonyms if they are distinguished from each other only by . . . the use of *ae*, *oe*, and *e*, as *caeruleus*, *coeruleus*, and *ceruleus*", no similar statement is made for generic names. Presumably the same ruling must be applied to genera, although not definitely stated, since the rejection of homonyms is governed by similar rules for genera and species

¹ *Travaux de la Station Biologique de Roscoff*, fasc. 3. Paris 1925.

² Forbes & Hanley, *British Mollusca*, vol. i, p. 367 (1848).

³ Compare *Victoria County History of Cornwall*, vol. 1, p. 144.

⁴ Vol. 3, p. 298 (1932).

⁵ Scientific Latin is not necessarily classical Latin. As an example of later Latin orthography, I will quote the two phrases *Rex glorie* and *fines terre* from a psalter now in front of me.

(arts. 34, 35). *Acmæa* therefore, being no longer available for the limpet, *Patelloida*, becomes the earliest name available for this genus.

ASSIMINEA v. SYNCERA (p. 223).

I do not see that it is possible to regard *Syncera* Gray 1821 otherwise than as a *nomen nudum*. However the question is raised in *Venus*, and the name is actually used by some systematists. The original account¹ of *Nerita Syncera hepatica* refers to "the eyes appearing to be at the end of the tentacula", and no other character of shell or animal is given. This character applies to *Assiminea* and *Paludinella*, as well as to certain Strombidæ, Clausiliidæ, some Pupillidæ, and a few Turrids; it may also appear to be the case in several other mollusca, where the tentacles are partly retracted. Gray's further surmise that this appearance was due to fusion of eye peduncle and tentacle would suggest that the animal was not *Assiminea* or *Paludinella*, but some animal related to *Terebellum*, in which he saw some resemblance to *Nerita*. It is not until 1847, when Gray gave *Syncera* as a synonym of *Assiminea* in his List of Genera (no. 193), that we learn what *Syncera* was supposed to be, and that the *Nerita-Terebellum* chimera can be dismissed as a myth.

EULIMA and BALCIS (p. 225).

This is a troublesome problem in which attention must be given to the names *Strombiformis*, *Melanella*, *Eulima*, and *Balcis*.

Strombiformis da Costa 1778 was first applied to this group by Iredale² in 1915, who designated *S. glaber* da Costa as the type. Unfortunately Iredale overlooked the earlier designation by Harris³ in 1894. It is true that Harris was under a misapprehension in supposing that the first species must be selected as type, but that does not alter the fact that he has definitely designated a type in the words "his first species, and therefore the type of the genus is *Turbo perversus* Linn." *Strombiformis* is not, therefore, available for generic use in this family.

Melanella Bowdich 1822⁴ forms the fourth group of Lamarck's *Melania* and is described as "Semi-transparent, mouth invaded by the last whorl; white. Turreted; spire curved. Marine." The only species associated with the name by Bowdich is *M. Dufresnii*,

¹ "A natural arrangement of mollusca," *London Medical Repository*, vol. 15, p. 239 (1821). The reference is quoted in full by Iredale, *Proc. Malac. Soc.*, vol. 15, p. 37 (1922). See also Jeffreys, *Brit. Conch.*, vol. 5, p. 101 (1869).

² *Proc. Malac. Soc.*, vol. 11, p. 293.

³ *Proc. Malac. Soc.*, vol. 1, p. 31.

⁴ *Elements of Conchology*, p. 27.

undescribed, but figured on pl. 6. This is presumably (from the footnote on p. 27) a fossil, and possibly a poor drawing of an Eulimid, but it seems to me more probable that it is a fairly good drawing of a Stiliferid, judging from the appearance of the whorls and the shape of the mouth: curved spires are not unknown in Stiliferidæ. As the type specimen has not been found, exact determination is not feasible, and the safest course is to avoid the use of the name *Melanella* until further evidence is available.

Eulima Risso 1826¹ contains four species: *elegantissima* Montagu, *glaberrima* Risso, *striata* Brocchi, and *subulata* Brocchi. *Turbo subulatus* in Brocchi is quoted as of Donovan. Herrmannsen 1846 designates *Turbo subulatus* Donovan as type, nullifying Gray's selection in 1847 of *Helix polita* L., which Gray no doubt considered to be the same as *glaberrima*.

Balcis Leach 1847² was first published posthumously by Gray in a list entitled "Classification of the British Mollusca by W. E. Leach, M.D., 1818". Of the three species quoted under *Balcis* two are nude, being undescribed and without reference, but *Balcis Montagui* is defined by its synonym *Helix polita* Montagu, which as the only recognizable species becomes the type of the genus.

Thus the generic names to be used in this family are:—

Eulima Risso [= *Strombiformis* auct.]. Type, *E. subulata* = *E. glabra* (da Costa).

Balcis Leach [= *Eulima* auct.]. Type, *B. montagui* = *B. alba* (da Costa).

For *Melanella* auct., Monterosato's VITREOLINA is available, and, until fuller knowledge is forthcoming, should be treated as a subgenus of *Balcis*.

NATICA (p. 228).

Some authors have attempted to draw a sharp line between the Naticids which have a calcareous operculum as *Natica* and those that have a corneous operculum as *Polinices*. My own studies based on English, Mediterranean, and Indian species have convinced me that an attempt to classify Naticids primarily on this basis is bound to lead to unnatural grouping. It should be observed that the so-called calcareous operculum has an outer calcareous layer and an inner corneous one. *Euspira*, in which most of our British species may be placed, is in most characters closely allied to *Natica*, and I accordingly regard it as a subgenus of *Natica*, which lacks

¹ *Hist. Nat. Europe Merid.*, vol. 4, p. 123.

² *Ann. Mag. N.H.*, vol. 20, p. 271.

the calcareous layer of the operculum, rather than as a subgenus of *Polinices* (type species *mammilla* L.), from which it differs in so many shell characters.

It will be noted that I have used *Euspira* instead of *Lunatia*, as I am now convinced from an examination of a series of *Natica glaucinoides* J. Sowerby, the type of *Euspira*, that the differences between the Eocene *glaucinoides* and the Recent species I listed under *Lunatia* are not sufficient to warrant separate subgeneric names. For *Lunatia* Gray 1847, it is therefore necessary to substitute :—

S.G. EUSPIRA Agassiz 1838. *Natica glaucinoides* J. Sowerby.

The earlier *Ampullina* Bowdich 1822 is difficult to interpret: as usually understood, it represents the group typified by *Natica depressa* Lamarck, which certainly has no close relatives among recent British Naticids.

OCENEBRA (p. 229).

The earliest published spellings ¹ of this name are both *Ocenebra*, although it is often quoted as *Ocinebra*, which was the later spelling,² and quite possibly the intended form of the name, but its etymology is too dubious to allow us to presume a misprint in 1847; the earlier spelling must accordingly be adopted.

Tritonalia Fleming 1828³ has sometimes been used for this genus. On p. 356 we find *Murex erinaceus* and eight other fossil species assigned to *Triton*. It seems that when the index was prepared, Fleming noticed that he had used *Triton* twice—*Triton* Laurenti for batrachians and *Triton* Montfort for mollusca. He accordingly substituted *Tritonalia* for the latter, and the only description of this name is in the list of corrigenda to be found in some copies of the book, where we are instructed to read *Tritonalia* for *Triton* on p. 346 and on p. 356. The reference to p. 346 is to a list of all the genera then placed in Muricidæ, whether represented by British species (e.g. *Triton*) or not (e.g. *Ranella*); so that it is clear that *Tritonalia* is intended as an emendation of *Triton* Montfort, and not a new genus for the nine British species. As a substitute name, it is equivalent to *Triton* and must have the same type, namely *Murex tritonis* L.

Thiele⁴ considers *Ocenebra* and *Vitularia*⁵ to be subgenera of

¹ Leach, *Ann. Mag. N.H.*, vol. 20, p. 269 (Oct. 1847); Gray, *Proc. Zool. Soc.*, 1847, p. 133 (Nov., 1847).

² Leach, *A Synopsis of the Mollusca of Great Britain*, p. 117 (1852).

³ *A History of British Animals*, corrigenda, following index.

⁴ *Handbuch*, p. 299 (1929).

⁵ Swainson, *A Treatise on Malacology*, p. 297 (1840).

the same genus, in which case *Vitularia* has priority as the generic name. I should, however, recommend separating them as distinct genera.

NEPTUNEA (p. 229).

Neptunea Röding 1798¹ requires notice, as a few authors still use the later name *Chrysodomus* Swainson 1840. I do not think anyone will dispute the propriety of regarding *Murex antiquus* L. and its sinistral form, *Murex contrarius* L., the Crag fossil called *Trophon antiquum* var. *contrarium* by S. V. Wood and *Murex despectus* L. as congeneric, whatever limits may be assigned specifically. Accordingly *Chrysodomus* with type *C. argyrostomus* Swainson (= *antiquus*) falls into the synonymy of *Neptunea*. Iredale in 1921² designated *N. despecta* the first species as type, but a type had already been selected nearly fifty years earlier by Monterosato,³ when he mentioned "*F[usus] antiquus* monst. *contrarius* ch'è il tipo del genere *Neptunea* di Bolten". This refers to Bolten's, i.e. Röding's, fifth species, *N. contraria*, based on Chemnitz, vol. 9, figs. 894, 895, which represent the Crag form from Harwich.

A more serious rival to *Neptunea* is *Tritonium* Müller,⁴ as Gray in 1847, although listing *Tritonium* six times, only refers to *Tritonium* Müller once, when he gives *Murex antiquus* as type. However, Schumacher in 1817 included *Tritonium* Fabricius among his genera, selecting as type "*Tritonium undatum* Fabrit. Müller". As the *Tritonium* of Fabricius⁵ is taken from Müller and exactly the same assemblage of species (excluding those not common to the two faunas) occurs in the two works, I think we may justifiably adopt Schumacher's type of "*Tritonium* Fabrit." as fixing the type of *Tritonium* Müller and treat the name as a synonym of *Buccinum* L.

¹ *Museum Boltenianum*, p. 115.

² *Proc. Malac. Soc.*, vol. 14, p. 206.

³ *Notizie intorno alle Conchiglie fossili di Monte Pellegrino e Ficarazzi*, p. 17 (1872).

⁴ *Zool. Dan. Prodomus*, p. 243 (1776).

⁵ *Fauna Groenlandica*, p. 395 (1780).

LIMAPONTIA DEPRESSA (A. & H.) var. nov. IN SCOTLAND.

By D. K. KEVAN.

(Read before the Society, 16th September, 1933.)

THE previous history of *Limapontia depressa* in Britain is a very brief one. The only records are those for Hylton Dene, near Sunderland, on which Messrs. Alder and Hancock based their original description of the species in 1862 (1), and Loughor Marsh, near Swansea, where it was taken by Mr. Moggridge and Mr. C. Spence Bate, and figured by the latter gentleman in his *Notes on the Fauna of Swansea and the Neighbourhood* (1849), although it appeared there under the name of *L. nigra*.

On 16th May, 1932, while collecting on a particularly interesting saltmarsh to be found at the mouth of the R. Tyne, near Tynninghame, to the west of Dunbar, East Lothian, I found a number of small slug-like molluscs, obviously belonging to the genus *Limapontia*, and on further examination I could only label them as a very definite variety of *L. depressa*. In general form and position of the vent, etc., they tallied with Alder & Hancock's original description of the species (1). In colour, however, they were yellow and green instead of black.

I was not able to visit the locality again for some time, and when I next looked for the species I could not find a single specimen.

Passing over the winter, therefore, I determined to start a fairly early investigation. On 19th March, 1933, I found further specimens of this *Limapontia*, and Dr. C. H. O'Donoghue kindly examined them and, as far as could be ascertained from externals, agreed that it appeared to be a variety of *depressa*. *Alderia modesta* (Lovén) referred to by A. & H. (1) was found in association on that date.

On 16th April following, *Limapontia* were abundant, and on this occasion a number of small dark olive to black specimens appeared, and the question arose as to whether these were juvenile reversions to type, or *Limapontia capitata* (*nigra*), which species had been found in the pools on the saltings at Aberlady (about 10 miles west as the crow flies) by Dr. E. A. T. Nicol. Unfortunately an accident resulted in their dying before examination could be made, and further specimens were secured on 14th May.

L. depressa were still abundant, while, again, a small percentage of the small dark olive to black individuals occurred. These were compared with *L. capitata* from Aberlady, and both Dr. O'Donoghue and Dr. Nicol were of opinion that they were this species. It seems evident, therefore, that both species of *Limapontia* are present, *capitata* being represented, somewhat sparsely, by both the black and the "transparent brownish-green" forms referred to by

When contracted the mollusc appears as a green bead, thinly ringed with yellow, and, both in its extended and contracted state, harmonizes very remarkably with the algæ and flora, making detection far from easy until its appearance becomes familiar.

The colour is quickly extracted by spirit, leaving the animal pure white, but in a weak solution of formalin it is retained for a long time, although gradually weakening and leaving the hepatic organ a dark and dingy green.

For this variety I propose the name *pellucida* as being less cumbersome and quite as applicable as a reference to its bi-colouration. It differs so obviously from its black prototype that it is undoubtedly worthy of varietal status.

I would like to add some notes regarding its habitat at Tynninghame, together with some observations, which must be considered as preliminary, with regard to breeding, etc. :—

Habitat.—Saltmarsh at the mouth of the River Tyne, East Lothian. The marsh is situated on the north side of the river and takes the form of a tongue, separated from the shore proper by a very narrow spit of land about $\frac{3}{4}$ mile in length, affording complete protection from the sea. This is best seen on the accompanying plan of the area.

A large tidal creek, gradually narrowing, and with numerous irregular branches, runs more or less centrally from the south end northwards, dying out as it approaches the top of the marsh.

Normal high-water mark : East to west from the point of the spit, irregularly across the south end of the marsh to the mouth of the river.

Normal low-water mark : A line running approximately north-west to south-east at the northern end of the rocks by "Tyne Mouth".

The marsh is only covered by the sea at high spring tides. On these occasions the creeks fill very quickly and the water then spreads slowly over the surface of the marsh. On other occasions the creeks may only fill partially, and at low tides not at all. There is no inflowing brook, but saturation (from the tides), rain, and percolation from the surround keep the marsh sufficiently wet in normal circumstances. In hot weather, however, the surface dries and cracks, the occasional pools disappear, and even the creeks may be dry or near-dry.

Flora.—Usual saltmarsh forms, consisting chiefly of *Armeria maritima*, *Glaux maritima*, *Suaeda maritima*, and *Salicornia* sp. The grass *Festuca rubra* occurs on any patch of drier land on the west side, giving way to a normal woodland and grassland flora as the margin of the marsh is reached. Bands of *Scirpus* sp. appear on the north and west margins.

Algæ.—At about two-thirds of the distance from the north end of the marsh *Pelvetia canaliculata* occurs in considerable patches, while a *Conferva* is generally present on the surface of the marsh, in the pools, and on the sides of the creeks.

Mollusca.—In the mud below normal high-water the usual estuarine species are to be found, i.e. *Scrobicularia plana* (*piperata*), *Macoma balthica*, *Mya arenaria*, and *Hydrobia ulvæ*, while, as this gives place to sand, *Cardium edule* and *Retusa obtusa* appear. On the marsh itself the following interesting association occurs:—

Hydrobia ulvæ.—Abundant and often reaching a length of 0.3 in.

Littorina saxatilis tenebrosa.—Abundant and, although mostly unicoloured or chequered, containing a percentage banded and coloured as *Littorina saxatilis rudis* on the shore proper.

Littorina littorea.—A well-established colony in one of the tidal creeks on the marsh; in hot weather *L. littorea* buries itself in the moist mud. Shell: well-developed, covered with mud and ferruginous matter.

Phytia myosotis.—Abundant.

In addition, of course, the three "seasonal" nudibranchs already mentioned, i.e. *Limapontia depressa* var., *Limapontia capitata*, and *Alderia modesta*.

Coleoptera.—As a further indication of the type of marsh I would mention that the following species are common: *Pogonus chalceus*, *Dichirotrichus pubescens*, *Bembidion minimum*, *Cillenus lateralis*, *Heterocerus marginatus*; while *Heterocerus sericans*, *Cafius xantholoma*, *Bledius spectabilis*, and others are not rare. These (as also other groups like *Hemiptera*, *Arachnoidea*, etc.), during the recurrent flooding at spring tides, survive quite happily in the tunnels which they or Crustacea (*Talitrus locusta*, for example) have dug in the mud.

Habits, Breeding, etc.—On the dates already mentioned, i.e. 16th May, 1932, and 19th March, 16th April, and 14th May, 1933, *Limapontia depressa* (as also *L. capitata* and *A. modesta*) were crawling on the surface of the marsh and not actually in the creeks or pools, although present on the sides of the former where covered with *Conferva*. It was particularly plentiful in the area of the marsh already mentioned where the alga *Pelvetia canaliculata* occurred, and the only flora consisted of *Suaeda* and *Salicornia*. As *Pelvetia*, etc., disappeared northwards and *Armeria* and *Glaux* became dominant, *Limapontia depressa* also tailed off, although isolated specimens were taken at the edge of a dried-up pool at the top of the marsh—probably floated up by the last spring tide.

It was not seen crawling on any of the plants, or the *Pelvetia*,

but appeared to be seeking out the cracks and crannies in the mud for protection and in order to deposit its eggs. It seemed particularly partial to situations where *Conferva* was plentiful, and it is probably this which constitutes its main food.

On 4th June *Limapontia* had disappeared completely from the surface of the marsh, which was dry and sun-cracked. In the cracks and under the "cakes" of mud which could be easily removed a few somewhat shrunken and sickly specimens were found, in company with the associates previously mentioned and other forms of life (Coleoptera, Crustacea, etc.), which, in their endeavour to escape the heat, had all been driven underground.

On 8th July, and again on 7th August, a further search was made, but no specimens could be found, and it now remains to be seen when the species makes its reappearance on the marsh. Alder & Hancock (1) found *L. depressa* in October, but state that Mr. Spence Bate's specimens seemed nearly twice as long as theirs. This points to the juvenility of the Sunderland animals, and to the possibility of a reappearance at Tynninghame in October or thereabouts.

As regards breeding, in the Tynninghame *locus*, this, owing to the drying up of the marsh surface, especially during the summer, has to take place over a restricted period, which, judging by the abundance of the species, is more or less confined to the months of April and May. The egg-capsules, ovate-cylindrical in form, are deposited on the mud; in captivity *L. depressa* deposited them on the alga placed in the water with them. These capsules averaged about 4 mm. in length and about 1.5 mm. in diameter, and from a count taken of a number of capsules contained 400-450 eggs of a decided yellow colour. The veligers were active on 29th-30th May, a fortnight after the eggs were laid, but the difficulty of reproducing anything like natural conditions prevented development and, unfortunately, no hatching took place.

From the fact that *L. depressa* breeds on the surface of the Tynninghame marsh, it would seem that this must be a natural habitat, although why this nudibranch should select such a situation for the purpose is one of those mysteries of evolution which must remain unexplained. Its associate *Alderia modesta* certainly crawls over the marsh, but only deposits its eggs in pools.

As regards the development and hatching of the ova and subsequent growth, two alternatives present themselves:—

- (1) That the complete life-cycle occurs on the marsh itself.
- (2) That it occurs partly on the marsh and partly in a true marine habitat.

In support of the first alternative it might be suggested that the

deposition of ova on the marsh is *prima facie* evidence that development also takes place in that situation ; that the surface of the marsh only being covered at high spring tides is an argument against migration of any sort, and points to the probability of the veliger (*a*) passing its free-swimming stage in the egg-capsule, hatching in perfect form and then burying itself deep down in the cracks and crannies where there might be sufficient moisture for it to live through the summer in safety ; or (*b*) hatching at the next spring tide when the marsh would be covered, and being carried down underground into situations sufficiently wet to permit of normal free-swimming activity and subsequent growth to adult form.

In support of the second alternative it can be argued that it would be more consistent with the known habits of nudibranchs, many of which come inshore to breed, and then (both adults and fry) disappear for another year ; that even in this apparently abnormal situation it would be possible for *L. depressa* to have a normal life-history, as the adults could arrive with the spring tides, spread over the marsh in favourable *loci*, and breed ; the eggs could develop on the damp surface, and hatch when the marsh was covered at the next spring tide, which as it slowly receded might carry a percentage of the minute veligers into the creeks and thence seawards, where they would assume adult form and return to the Tynninghame marsh as the breeding season again approached.

Both alternatives point to a very high mortality in the early stages of growth, whether on the marsh altogether or partly in the sea. Hot weather and a development so timed as to favour emergence from the capsule simultaneously with the arrival of the spring tides are but two of the difficulties which the veliger has to overcome, unless it can withstand the former and develops according to alternative 1 (*a*). It must be remarked, however, that alternative 1 (*a*) seems to be the least likely solution, 1 (*b*) possible, while alternative 2, perhaps, can be described as probable, but actual proof of either will be difficult to obtain, owing to the minute size of the veligers.

It is not suggested that the Tynninghame breeding habits are typical of the species : they may, in fact, be much modified by local conditions. Alder & Hancock (1) state they found *L. depressa* in brackish-water pools (at Hylton Dene, Sunderland), and in such situations, especially if subjected to daily tidal influences, more equable conditions may prolong the actual breeding period. At Tynninghame, however, from the disappearance of all adults during June, it can be assumed that the species lives one year only, and dies shortly after breeding. As to when it will reappear is presently a matter of conjecture, but I hope to find it again before the

end of the year in the same *locus*, when its ecology will be further studied.

Summary.—*Limapontia depressa* is now known to have a range extending from Swansea to Sunderland and the Tyne estuary (near Dunbar). It is, apparently, a species easily overlooked, but which is locally abundant at certain periods of the year. It requires definitely brackish situations for breeding, but while undoubtedly needing moisture in no mean degree, does not necessarily require submersion; its breeding period is April–May (possibly beginning earlier or ending later in favourable circumstances); the adult dies after breeding, and the new generation reappears within a period at present undetermined, but which might be the following October–November, assuming, as seems possible, that A. & H.'s original specimens were more or less juvenile.

As regards the new variety for which I have proposed the name *pellucida*, it is so distinctive in appearance, although conforming to type in general form, that the possibility of its proving to be a separate species cannot be overlooked. Only a complete anatomical examination can finally settle this question, and it is possible that Dr. O'Donoghue may agree to undertake the difficult task entailed in dealing with such a small animal as *Limapontia*. It is certain his findings would receive general acceptance.

BIBLIOGRAPHY.

- (1) ALDER & HANCOCK. *Ann. Mag. N.H.*, Ser. III, x, 264.
- (2) ——— Ibid., Ser. II, i, 401.

NOTES ADDED WHEN GOING TO PRESS.

The marsh was again visited on 5th September and 7th October with a negative result. On 3rd December, however—the occasion of the next visit—after a three hours' search the following were found:—

eight *L. depressa* var. *pellucida*,
one *L. capitata* (?),
two *Alderia modesta*,

and one egg capsule of *L. depressa*. On 9th December another visit was made to see if by any chance the December spring tides had resulted in any influx of the above species. The day was cold, windy, and rainy, and only three *Alderia modesta* were found.

All the above molluscs were juvenile, most of the *Limapontia* being very minute. One very small specimen is suggested as being *L. capitata*, as it had the appearance of beginning to develop pigmentation, besides (in water) being much more active than normal *depressa*. The eight *L. depressa* were certainly var. *pellucida*.

The egg capsule contained active veligers, which Dr. O'Donoghue suggested were about seven days old. This was an entirely unexpected find; it proves either survival on the marsh or the arrival from the sea in November (by the spring tides) of adults, and points to two breeding periods—a minor one in November–December and a major one in April–May.

The following points now suggest themselves :—

(1) That survival on the marsh during the summer months, whether under (a) or (b), seems very unlikely, for the following reasons :—

(i) Adults, breeding in April–May, disappeared completely in June.

(ii) April–May fry, if surviving on the marsh, would not develop so unequally as to provide both adults and extremely juvenile forms in November at the same time.

(iii) It seems unlikely, if any approaching-adult forms were present on the marsh in September–October, that they would have escaped notice entirely, as the surface was sufficiently wet to bring them to the surface.

(2) That *L. depressa* only reaches its adult form in a true marine habitat; that it breeds on the marsh, the veligers emerging when the spring tides occur, being swept out seawards as the tides recede, and returning in various stages of growth in October–November and March–April for the two breeding seasons. It is very significant that their appearance at Tynninghame in November and the period of greatest abundance in April–May appears approximately to coincide with the two chief spring tides of the year.¹ Now if the year be divided into three equal periods, say, October–January, February–May, June–September, it will be readily seen that the last period, comprising the hottest part of the year, can be ignored in considering the breeding habits of *L. depressa*. The questions which arise, however, from a consideration of the facts so far ascertained are :—

(1) Do the November juveniles develop into the adults of March, breeding in April–May? If so, why was the species not abundant in March? And how are the November adults explained?

(2) Are there two distinct races breeding in, say, October–November and April–May, or only one race with two waves of arrival, one (mainly juveniles) in October–November and one (mainly adults) in March–April?

¹ The March tide might not necessarily bring in the species in abundance, but it might enable the April tide to do so. Time cannot be fixed arbitrarily.

(N.B.—Specimens collected abundantly in April were much larger than those collected in May, but this, possibly, may be due to the former being swollen with eggs, and not to a further wave of arrival in May.)

It is difficult to form any definite opinion as yet, but I would suggest that there is but one race with a major breeding period in April–May; that juveniles begin to arrive in October–November and onwards, the main influx (then of adults) taking place in March–April, the earlier arrivals developing and breeding in normal circumstances at the same time. Favourable conditions on the marsh, however, might hasten growth and bring a proportion of the early-comers to maturity in February–March, the resulting veligers being carried into the main creek, on to the estuarine mud, or even further, by the March–April spring tides that bring in the main stream of adults. These veligers might possibly develop more quickly and return as the November adults, and being adult would presumably breed on reaching the breeding-ground, thereby establishing what might appear to be a distinct race, which, however, might die out as quickly as it arose. In the unstable conditions that obtain on a marsh there is bound to be unevenness of development, resulting in favourable circumstances in a secondary breeding period. This secondary period is not uncommon in other nudibranchs and generally takes place at about the same time of the year.

The reappearance of *L. depressa*, as hopefully predicted in the body of this paper, has undoubtedly brought the solution to the problems in connection with this species much closer. Attempts will be made during the next five or six months to settle the main questions that have arisen, and to get further insight into the habits of this interesting mollusc.

Habitat of *Facelina drummondi* (Alder & Hancock).—I have notes of a rather unusual habitat of this species in Belfast Lough. The shore at Greenisland, about 9 miles from Belfast on the north side of the Lough, is flat and sandy, with frequent low reefs of rocks running out from the land, and in places the sand has been scoured away, exposing beds of red Trias marl, where *Barnea candida* (Linné) and *Zirfæa crispata* (Linné) live. Here *Facelina* occurs fairly plentifully in the empty *Pholas* burrows, usually associated with *Paphia saxatilis* (Fleuriau) at half-tide mark. I have found specimens thus at all times from March until late October, and cannot remember ever having found them save in the burrows, though I may have taken an odd one elsewhere. Alder & Hancock¹ give as habitat “under stones between tidemarks, and in shallow water”, and Colgan,² though he usually dredged this species, mentions having found one on a *Zostera* bed. I would be glad to know if *Facelina* has been commonly found in *Pholas* burrows elsewhere.—N. FISHER.

¹ Alder & Hancock, *Monograph British Nudibranchiate Mollusca*, pt. iv (1848), fam. 3, pl. 13.

² Colgan, N., “The Opisthobranchiate Fauna of the Shores and Shallow Waters of County Dublin,” *Irish Naturalist*, 23, pp. 187–8, 1914.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND.

611th (Annual) Meeting, held in the Rooms of the Royal Society, Burlington House, London, on Saturday, 7th October, 1933.

The President, Mr. J. E. Cooper, in the chair.

Among those present were Messrs. R. Garnett, J. G. Dalglish, A. G. Stubbs, A. P. Gardiner, G. Shrubsole, A. Wrigley, H. W. Worsfold, G. C. Spence, A. S. Kennard, H. Overton, G. L. Wilkins, W. J. Davey, F. M. Dyke, H. C. Fulton, A. E. Ellis, J. D. Dean, T. W. Twiggs, H. C. Huggins, C. Oldham, R. Winckworth, A. E. Salisbury, R. J. Welch, J. R. le B. Tomlin, Miss K. M. White, Miss Nora Fisher, Miss J. D. Robertson, Mrs. C. Oldham, Mrs. A. S. Kennard, Mrs. H. Fulton, Mrs. H. Overton, Mrs. A. Wrigley, Mrs. E. M. Morehouse, Capt. C. Diver, Dr. C. Price-Jones, and Dr. J. W. Jackson.

Appointment of Scrutineers.

Messrs. J. G. Dalglish and H. W. Worsfold were appointed scrutineers.

Appointment of Auditors.

Messrs. C. H. Moore and F. Taylor were reappointed auditors.

Election of Trustee.

Mr. R. Winckworth was elected Trustee in place of Mr. B. R. Lucas (resigned).

Election of Honorary Member.

The Rev. Dr. A. H. Cooke was unanimously elected an Honorary Member.

Candidates Proposed for Membership.

Ralph Hope Lowe, B.A., 54 Queen's Crescent, Sunderland, Co. Durham.
J. Newton, B.Sc., 86 Colchester Terrace, Sunderland, Co. Durham.
(Both introduced by the Rev. E. Percy Blackburn and Dr. J. W. Jackson.)

Presidential Address.

The President (Mr. J. E. Cooper) gave an address on "Oldhaven and Thanet Sand Mollusca of Herne Bay", and a cordial vote of thanks was passed unanimously.

Votes of thanks were also accorded to the authorities of the Royal Society and the Manchester Museum for the use of rooms for meetings.

Election of Officers and Council.

The Officers and Council for 1933-4 were unanimously elected as nominated (see p. 1).

Exhibits.

By Mrs. Morehouse : Series of *Polygyra*.

By Mr. R. Winckworth : Series of *Chlamys townsendi* (Sow.) from Karachi, to illustrate shell growth.

By Mr. G. C. Spence : *Archachatina spectaculum* Pilsbry ; *Urocoptis livida* Torre.

By Mr. H. Overton : Colour photograph of *Arion ater* ; high-spired *L. peregra* and very large *L. truncatula* from Walderton, Sussex.

By Dr. J. W. Jackson : Varieties of *Patina pellucida* (L.) from Ballintoy shore ; *Patella vulgata* L., *C. zizyphinum conuloide* (Lam.), *G. umbilicalis* (da Costa), and *N. lapillus* (L.), from the top of the raised beach in Park Lane, Ballintoy.

By Mr. J. G. Dalglish : Helices from Sussex, Kent, and Hants ; association of *Macra corallina cinerea* and *Pinnotheres pisum*.

By Mr. G. L. Wilkins : Eggs of *Sepia officinalis* L. and *Loligo vulgaris* Lam. ; vars. of *N. lapillus* (L.) ; *Gastrochæna dubia* (Penn.) on *Spondylus* ; *Barnea candida* (L.), *Clavagella aperta* Sow., and *C. melitensis* Brod. *in situ*.

By Mr. A. E. Ellis : Living *Hygromia odeva* (Locard) from Coombe Cellars, Devon, where they were numerous in hedge-bottoms amongst dead leaves.

By the President : Books which once belonged to Dr. J. G. Jeffreys ; *Lym. palustris* var. *elongata* Moq. (Herne Bay) and f. *albida* Nelson (Chislet Marshes).

By Mr. J. R. le B. Tomlin : Species of *Helicostyla* just received from Mindoro ; growth stages of *Tonna*, including operculated embryos ; *Pleurotomaria hirasei* Pilsbry from the coast of Kii ; rare species of *Trivia* and *Cancellaria*, including *T. acutidentata* (Gaskoin), *T. hordacea* (Kiener), *T. maugeri* Gray, *T. producta* (Gaskoin), the types of *T. rubinicolor* (Gaskoin), and *T. vesicularis* (Gaskoin), *C. textilis* Kiener, *C. thomasiana* Crosse, *C. scalata* Sow., and *C. trigonostoma* Blainville.

By Mr. A. G. Stubbs : Long series of *Cepæa nemoralis* L. from Woodingdean, Sussex ; drawings of shells and wild flowers.

By Mr. H. W. Worsfold : Land shells showing normal and abnormal varieties, including sinistral specimens.

By Mr. A. S. Kennard : Pleistocene shells from France, including *C. nemoralis major* Fér. and *Elona quimperiana* (Fér.) from Gourdan—new records for French Pleistocene, *Trochulus odeva* (Loc.) from Gourdan, *C. hortensis* (Müll.), and *Eulota choquetiana* Tour. from Elbeuf.

By Mr. C. Oldham : (1) *H. aspersa* from Mablethorpe, Lincs., to illustrate the recessive character of yellow shells (*exalbida*) : one of these mated with a brown from Hants yielded 183 young, all brown, but the yellow character reappeared when these browns were mated (2) *H. aspersa*, albino animals, the F 2 generation of a snail with brown shell and albino animal and one with yellow shell and grey animal. (3) *H. pomatia* living on granite rocks at Linné's Hammarby, near Upsala ; it is not indigenous in Southern Sweden, but is naturalized in many places and is said to have been introduced by Linné himself on the grounds of his country house at Hammarby. (4) *Geomalacus maculosus*, eggs and newly hatched young, the F 2 generation of a slug collected at Glengarriff in August, 1929.

By Mr. C. Oldham and Capt. C. Diver : Maps of the South Haven Peninsula Survey, Studland Heath, Dorset, viz. :—

- (i) Maps showing stages in the growth of South Haven Peninsula.
- (ii) Maps showing (1) geological formations, (2) main plant communities.
- (iii) Maps showing the distributions of the species of Mollusca found during the Survey. These include : Land Mollusca, 28 species ; Fresh-water Mollusca, 6 species ; Brackish water, 1 species ; total, 35 species.

ANNUAL REPORT.

This is the Fifty-Seventh Annual Report of the Society. Since the last Annual Meeting the Society has lost seven members by death, seven by resignation, and two have been struck off the list through non-payment of arrears. Only one new member has been elected during the year. The membership at the present time is 223, including the four Honorary Members.

The losses by death are : H. J. Stobart, Col. E. C. Freeman, A. W. Wincott, Rev. E. H. Nash, A. W. Pye, W. Gyngell, and Rev. E. N. Dalton.

Six ordinary meetings have been held at the Manchester Museum by the kind permission of the authorities. On 12th November there was a joint meeting with the Yorkshire branch, held at the University, Leeds, when the Hon. Secretary, Dr. J. Wilfrid Jackson, gave a lantern lecture on " Shell

Lore", and dealt with the uses of shells as charms and amulets and in many other ways, both in the past and at the present time. There were many interesting exhibits at this meeting, most of which had a bearing on the subject. On 8th April a joint meeting of the Yorkshire and Manchester members was held at the Manchester Museum, when there was a good attendance and a good display of specimens.

One Special Exhibit was held in January, viz. *Thiara*.

Twenty-six notes and papers have been read during the year, and some of these have appeared in the *Journal*.

Three numbers of the *Journal* have been issued to members since the date of the last Annual Meeting, viz. Vol. XIX, No. 8, October, 1932, containing 32 pages of text and a portrait of the late J. R. B. Masefield; Vol. XIX, No. 9, February, 1933, with 32 pages of text and one text-figure; Vol. XIX, No. 10, June, 1933, with 32 pages of text, one sketch-map, and 24 text-figures. The above *Journals* were received from the publishers by post as follows: No. 8, 26-10-32; No. 9, 3-3-33; and No. 10, 22-6-33. A further number of the *Journal* is in preparation, and will be issued to members shortly; it will complete Vol. XIX.

On 3rd and 4th May last Capt. Cyril Diver represented the Society at the Centenary Celebrations of the Entomological Society of London, and presented a congratulatory address.

Additions to the Library have been received from Lieut.-Col. W. H. Turton, Messrs. H. Schlesch, G. C. Spence, H. H. Bloomer, J. F. Musham, Fridthjof Okland, Von M. Rotarides, A. S. Kennard, Arthur Blok, Dr. P. Bartsch, and Dr. H. A. Pilsbry. Dr. A. W. Bowell also presented a bound volume of reprints on *Radulæ*, also MSS. on same. Mrs. Freeman presented a large number of useful books from the library of her late husband, Col. E. C. Freeman.

There have been several additions to the Cabinet from Messrs. H. Schlesch, W. H. Davies, and R. Waterston (voucher specimens).

The Hon. Librarian and Curator has presented a report on the J. W. Taylor Collection, stating that he has made considerable headway with the arrangement during the last twelve months. There are two cabinets, a large and a smaller one. It was found expedient to divide the collection into three sections. One portion, already mounted in rectangular glass-topped boxes, has been arranged in the smaller cabinet practically in the order of the Society's 1902 list of Non-Marine Mollusca; another portion, mounted on cards, has been arranged in great part in the large cabinet, some specimens having to be remounted; and a third portion, consisting of specimens in glass tubes, is now being dealt with along with numerous examples in chip-boxes and other receptacles. Some two hundred sets out of this miscellaneous lot have been mounted and placed with the carded section. With regard to the remainder, it is proposed to place them in glass-topped boxes ultimately, if the funds of the Society will allow. They are at present placed together in the large cabinet.

RECORDER'S REPORT (Non-Marine Mollusca).

SINCE the last report (Vol. XIX, p. 344) 83 new records have been authenticated for the Census.

Cornwall, E. (2): *Anodonta anatina* (A. E. Boycott).

Devon, S. (3): *Helicella itala* (A. S. Kennard), *Phytia myosotis* var. *ringens* (A. R. Waterston).

Dorset (9): *Anodonta anatina* (W. D. Lang).

Kent, W. (16): *Zonitoides excavatus* (F. H. Gripper).

Herts (20): *Milax gracilis* (A. E. B.).

Middlesex (21): *Caecilioides acicula* (A. C. Thomas).

Suffolk, W. (26): *Milax sowerbii* (G. Master).

Cambridge (29): *Pisidium personatum* (H. Overton).

- Salop (40) : *Pseudanodonta* (Severn : C. Oldham).
 Pembroke (45) : *Milax gracilis*, *M. gagates* (H. E. Quick).
 Yorks, S.W. (63) : *Physa heterostropha* (cistern at Doncaster : E. M. Morehouse).
 Northumberland, S. (67) : *Clausilia cravenensis* (G. W. Temperley).
 Dumfries (72) : *Pisidium henslowanum*, *P. milium*, *P. obtusale*, *P. personatum*, *P. pulchellum*, *P. subtruncatum* (D. K. Kevan and A. R. Waterston).
 Kirkcudbright (73) : *Pisidium cinereum*, *P. hibernicum*, *P. lilljeborgii*, *P. milium*, *P. nitidum*, *P. obtusale*, *P. subtruncatum* (D. K. K. and A. R. W.).
 Wigtown (74) : *Pisidium cinereum*, *P. hibernicum*, *P. lilljeborgii*, *P. milium*, *P. nitidum*, *P. obtusale*, *P. personatum*, *P. pulchellum*, *P. subtruncatum* (D. K. K. and A. R. W.).
 Berwick (81) : *Helicella caperata caperata*, *Hygromia striolata*, *Vertigo substriata*, *Ancylus lacustris*, *Planorbis nautilus*, *Pl. spirorbis*, *Valvata cristata* (D. K. K.).
 Haddington (82) : *Vallonia pulchella pulchella* (prob. holocene), *Zonitoides nitidus* (D. K. K.).
 Perth Mid. (88) : *Zonitoides nitidus* (A. R. W.).
 Elgin (95) : *Punctum pygmaeum*, *Vertigo substriata*, *V. pusilla*, *Carychium minimum*, *Pisidium hibernicum*, *P. lilljeborgii*, *P. nitidum*, *P. obtusale* (A. E. B.).
 Easternness (96) : *Acanthinula aculeata*, *Helix arbustorum*, *Ena obscura*, *Pupa umbilicata*, *Vertigo substriata*, *Succinea pfeifferi*, *Limnæa truncatula*, *Pisidium personatum* (A. E. B.).
 Westernness (97) : *Limnæa truncatula* (A. R. W.).
 Clyde Is. (100) : *Ena obscura* (J. E. Forrest).
 Ebudes, N. (104) : *Agriolimax lævis* (A. R. W.), *Paludestrina stagnalis* (M. I. Crichton).
 Hebrides (110) : *Hygromia hispida* (dead shells only), *Paludestrina ventrosa* (new to Scotland : E. A. T. Nicol), *Agriolimax lævis*, *Helicella caperata caperata*, *Pupa marginata*, *Vertigo antivertigo*, *V. pygmaea*, *V. lilljeborgii*, *Succinea pfeifferi*, *Limnæa palustris*, *Aplexa hypnorum*, *Paludestrina jenkinsi*, *P. stagnalis* (A. R. W.), *Pisidium lilljeborgii*, *P. nitidum* (C. Elton).
 Kildare (125) : *Acme lineata* (D. K. K.).
 Mayo, W. (138) : *Vallonia pulchella pulchella* (C. O.).

The accurate differentiation of the five species of *Succinea* which must now be recognized (*S. putris*, *S. elegans*, *S. pfeifferi*, *S. oblonga*, *S. arenaria*) has been put on a much more definite basis by the anatomical work of H. E. Quick (*Proc. Malac. Soc.*, 1933, vol. xx, p. 295), and it is most desirable that living specimens should be submitted for authentication especially when immature or poorly grown. The status of *S. putris* in the north of England and in Scotland is particularly uncertain ; so far it has been verified only from Kirkcudbright : specimens from Dumfries, Ayr, Peebles, Selkirk, Fife, Perth (S.), Perth (Mid.), Perth (N.), Easternness, and Clyde Is. have all been *pfeifferi*.

YORKSHIRE CONCHOLOGICAL SOCIETY.

Annual Report of the Yorkshire Branch.

IN spite of the exceptionally dry season of 1933 and the resultant paucity of captures, the Yorkshire Branch has had a successful year and increased enthusiasm has been shown by the members. The Officers for 1933 were :—

President : Charles Allen ; *Vice-Presidents* : J. C. North, F.R.P.S.L., and K. G. Howell. *Council* : K. Howell, W. Gyngell, Miss K. Morehouse, and Miss E. Dufty. *Secretary and Treasurer* : J. R. Dibb, F.R.E.S. *Recorder* : H. J. Armstrong.

We regret to announce the death of Mr. W. Gyngell, of Scarborough, who was a member and also served on the Council for many years.

Up to the present eight meetings have been held, which included four summer excursions. The Council is gratified to note an improved attendance. The opening meeting in January was devoted to "Short Papers and General Exhibits", and was well supported as follows:—

"Practical Methods of Killing and Preserving Slugs," by K. Howell.

"*Helicostyla* and *Cochlostyla*," by H. J. Armstrong.

"The Genus *Liguus*," by Mrs. E. M. Morehouse.

"*Helix pomatia*," by Mrs. E. M. Morehouse.

"A rare Publication known as *The Naturalists' Scrap Book of the Liverpool District*," shown and discussed by J. D. Firth.

At the February meeting for exhibits one of the most interesting features was the description of the internal structure of *Anodonta cygnea*, by Miss K. Morehouse, who brought a freshly killed specimen, which was partially dissected to illustrate her remarks. The Ravensknowle Museum, Huddersfield, was visited in March to review the fine collections of shells, under the guidance of Mr. J. C. North. A joint meeting with the parent Society was held at Manchester Museum in April, and a full report of this has appeared elsewhere. An excursion to Agbrigg, near Wakefield, under the leadership of Mr. J. D. Firth, was made in May with good results. A well-attended meeting at York was held in June, with the President and Mr. H. Sowden as leaders, for the investigation of the River Foss, with rather disappointing results from this usually prolific locality. This was a joint meeting with the York Field Naturalists' Club and the Yorkshire Naturalists' Union. In September the Cridling Stubbs District near Pontefract was visited, being a joint meeting with the Doncaster Scientific Society and the Yorkshire Naturalists' Union.

Three meetings are yet to be held to complete the year's programme. The 37th Annual Meeting will be held early in October. In November a joint meeting with the parent Society will take place in Leeds. Finally, a lecture by Mrs. E. M. Morehouse will be given in December.

Membership now stands at 32.

JOHN R. DIBB,
Hon. Secretary.

ANNUAL REPORT OF THE LONDON BRANCH.

ALTHOUGH there is not a great deal of particular note to report, the 1932-3 Session closed with every sign of a successful year. Mr. A. S. Kennard once again occupied the chair. The attendance has been good on the whole, averaging seven Members at each meeting, but it is hoped that this average will increase during the next Session.

The syllabus arranged for the nine meetings has been worked through as printed, all members contributing their share of notes and exhibits. The meetings partly devoted to "Cephalopoda", "Rare and Interesting Conchological Books", and "Practical Hints on Collecting" proved very popular; on the last occasion members gave their own experiences which, although sometimes amusing, were highly instructive.

The 1933-4 Session, for which the syllabus has already been circulated, commences with the Annual General Meeting on 9th October, 1933.

GUY L. WILKINS,
Hon. Secretary.

612th Meeting, joint with the Yorkshire Conchological Society, held at Leeds, 11th November, 1933.

Mr. C. Allen (President of the Yorkshire Society) in the chair.

Among those present were Messrs. H. J. Armstrong, K. Howell, K. G. Howell, J. Digby Firth, C. H. Moore, A. K. Lawson, J. H. Lumb, Dr. J. W. Jackson, and Mrs. Morehouse.

New Members Elected.

Ralph Hope Lowe, J. Newton.

Life Membership Fund.

To Amount of Fund, 1st January, 1933	£	s.	d.	
" Donation	.	320	4	4
" Dividends and Interest	.	.	3	3
	.	15	15	10
	£336	3	5	

By Transfer to Income and Expenditure Account	£	s.	d.
" Amount of Fund, 31st December, 1933	330	0	0
	£336	3	5

Research Fund.

To Amount of Fund, 1st January, 1933	£	s.	d.
„ Dividends and Interest	.	216	6 1
	.	10	12 4
	£226	18	5

By Grants to Authors for Illustrations	£	s.	d.
„ Amount of Fund, 31st December, 1933	.	4	0 6
	.	222	17 11
	£226	18	5

BALANCE SHEET.

LIABILITIES.

Annual Subscriptions paid in advance	.	.
Life Membership Fund	.	.
Research Fund	.	.
Authors' Reprints (estimated)	.	.
Estimated cost of glass-topped boxes	.	.
Balance of Income and Expenditure Account—		
As on 1st January, 1933	24	6 7
For 1933	7	4 11

ASSETS.

Investments.

4% Funding Loan, £365 8s. 7d., cost	£	s.	d.
4½% Conversion Loan, £202 13s. 3d., cost	300	0	0
3½% Conversion Loan, £40 11s. 8d., cost	200	0	0
	40	0	0
Cash at Bankers	540	0	0
	49	19	7
	£589	19	7

NOTE.—Assets in addition to those set out in the Balance Sheet are (a) Library, (b) Cabinets and Collections, (c) Stock of unsold Publications, (d) Annual Subscriptions in Arrear.

CHAS. OLDHAM.

Audited and found correct,
C. H. MOORE.
FRED TAYLOR.

Candidate Proposed for Membership.

Horace Warnes Cushing, B.A. (Cantab.), F.R.G.S., Ramsden House, Elland, Yorks (introduced by J. R. Dibb and Mrs. Morehouse).

Papers Read.

"*Melanopsis doriæ* Issel, new variety," by H. E. J. Biggs.
 "Achatina fulica (Fér.) in Nederland East Indies," by Miss Tera van Benthem Jutting.

Exhibits.

By Mr. H. J. Armstrong: Large and fine collection of Urocoptidæ; West Indian openclatates; and *Epiglypta howinsulæ* (Cox) from Lord Howe Is.

By Mrs. Morehouse: British and Foreign examples of *H. pisana*; also *H. candidissima* Drap. and *H. aperta* Müller.

By Mr. K. Howell: *Tethys punctata* Cuvier from Scarborough.

By Mr. K. G. Howell: Water-colour drawings of Ammonites from Broderick Collection, painted by T. Robins.

By Mr. C. H. Moore: L. and F.W. shells damaged by birds and animals (from the J. W. Taylor Collection); also *Anodonta cygnea*, from Newton, near Hyde.

By Dr. J. W. Jackson: Band-variation of *Helix nemoralis* and *H. hortensis* (from the J. Kidson Taylor Collection).

By Mr. C. Allen: Living *Planorbis corneus*.

613th Meeting, held at the Manchester Museum, 9th December, 1933.

Mr. G. C. Spence in the chair.

New Member Elected.

H. W. Cushing.

Papers Read.

"Names of British Mollusca: II," by R. Winckworth.

"On the Occurrence of Locally Extinct Marine Mollusca in the Sand-dunes at Portstewart, Co. Londonderry," by Miss Nora Fisher.

Exhibits.

By Mr. G. C. Spence: *Tropidophora* from many localities.

By Mr. C. H. Moore: Large series of *Cypræa*.

614th Meeting, held at the Manchester Museum, 13th January, 1934.

Mr. G. C. Spence in the chair.

Resignation.

Roland Garnett.

Paper Read.

"*Vallonia costata* (M ll.), monstrosity from East Lothian," by D. K. Kevan.

Exhibits.

By Mr. C. H. Moore: Series of *Conus*.

By Mr. F. Taylor: *Clausilia* and dissected *clausia* from many localities; *Balea perversa* from Grasmere.

By Mrs. Morehouse: *Mactra stultorum*, with blisters on interior of shell, from Scarborough; *Helix nemoralis*, with abnormal growth of mouth, from Wentbridge; *Planorbis spirorbis* and abnormal forms from Almholme, near Doncaster; *Planorbis corneus* from Methley and St. Neots; also white variety from the canal at Stroud; *Bithynia tentaculata* (very large) from River Foss at York.

The Special Exhibit was "Abnormal British Shells", and many interesting specimens were shown.

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CONTENTS.

	PAGE
Genital Dimorphism in <i>Zonitoides</i> (with figures)—HUGH WATSON . . .	33
<i>Achatina fulica</i> (Fér.) in the Netherlands East Indies—Miss T. v. B. JUTTING . . .	43
Cephalopods from the Cape of Good Hope—Dr. K. H. BARNARD . . .	44
<i>Cypræa vinosa</i> Gmelin in a Saxon Woman's Grave in Somerset—Dr. J. W. JACKSON . . .	46
A Reputed Smooth-shelled var. of <i>H. aspersa</i> —C. OLDHAM . . .	48
<i>Isidorella pyramidata</i> Sow. : A correction (with figures)—Dr. H. E. QUICK . . .	50
Names of British Mollusca—III—R. WINCKWORTH . . .	51
Bionomics of a Brackish-water Nudibranch, <i>Limapontia depressa</i> —Dr. P. PELSENEER . . .	54
Occurrence of <i>Amnicola taylori</i> and <i>B. leachii</i> in Scotland—R. WATERSTON . . .	55
Giant Form of <i>Pl. corneus</i> —L. E. ADAMS . . .	57
A New Species of <i>Lucina</i> (Plate I)—A. E. SALISBURY . . .	58
<i>L. pereger</i> var. <i>maritima</i> Jeff. at Gullane Point, Firth of Forth (with figures)—D. K. KEVAN . . .	59
Supposed New Var. of <i>Melanopsis doriae</i> Issel—H. E. J. BIGGS . . .	60
The Colouration of <i>N. lapillus</i> L.—G. L. WILKINS . . .	61

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No. 2.

GENITAL DIMORPHISM IN ZONITOIDES.

By HUGH WATSON, M.A.

CONTENTS.

	Page
Introduction	33
<i>Zonitoides nitidus</i> (Müll.)	33
<i>Zonitoides excavatus</i> (Bean)	40
Other Zonitidæ	42
Summary	42

INTRODUCTION.

THE British species of *Zonitoides* show an unusual amount of diversity in their genital ducts. Thus, the duct that passes back from the capsule that surrounds the anterior part of the penis and dart-sac opens into the receptacular duct alone in many specimens of *Z. excavatus* and probably in a few examples of *Z. nitidus*. But in other specimens of both species it communicates at its hinder end not only with the receptacular duct, but also with the oviduct, by means of a short transverse connection. And in still further examples of *Z. nitidus* I find that it only opens into the oviduct, its apparent connection with the receptacular duct consisting merely of connective tissue or muscle-fibres.

I hope, however, to be able to discuss this peculiarity more fully in the course of a subsequent paper. In the present article I will therefore only attempt to deal with the much more conspicuous dimorphism of the penis, epiphallus, prostate gland, and dart-apparatus, which we find in these snails.

It will be convenient to consider the two species separately, beginning with *Z. nitidus*. But first I wish to express my thanks to Professor A. E. Boycott, R. A. Phillips, C. O. van Regteren Altena, and others, who have together kindly furnished me with more than a third of the specimens on which my researches have been based.

ZONITOIDES NITIDUS (Müll.).

In 1883 Charles Ashford¹ stated that out of about a hundred specimens of *Zonitoides nitidus*, obtained from Yorkshire and

¹ *Journ. of Conchol.*, vol. 4, p. 109.

Hampshire in July and August, only one had a dart ; and that the rest seemed to have the dart-sac in a very early stage of development, though the shells in most cases were apparently mature. In 1897 W. Moss¹ said that out of eleven examples of the same species gathered at Bardsley, near Ashton-under-Lyne, in March and April, only three had darts, although all the shells seemed to be mature. In the remaining specimens the dart-sac was finger-shaped, without any trace of the peculiar lobe of the dart-bearing forms, and the calcareous organ in the penis was also absent. He added that the difference in the size of the genital organs of the two types was very conspicuous, and as no immature darts or transitional dart-sacs had been found the point awaited further elucidation.

J. W. Taylor,² in 1908, stated that specimens examined up to and including May were usually furnished with a dart, while those examined in the later months were almost invariably without it. But more recently H. B. Baker³ has pointed out that it is not entirely a matter of seasonal periodicity, as five of the seven specimens of this species that he dissected were collected in Michigan on the same day in the middle of July, and they included both types. The one with a dart and a relatively large dart-sac and penis he terms the male phase, and the one with the very small dart-sac and penis and no dart he terms the female phase ; and he states that this species evidently has a strong tendency towards separation of the male and female sex-functions, although one animal he dissected seemed to be more or less intermediate. He points out, however, that more work will be required to prove whether a single animal acts as both male and female during different periods of its life, the species being protandrous to an unusual degree, or whether an individual is permanently specialized towards a single sex, though he thinks that the latter condition is the more probable. On the other hand, J. Thiele⁴ seems to prefer the view that the two forms develop successively during the animal's life, as he states that in *Zonitoides*, *s.s.*, the male and female parts usually are not mature simultaneously.

If the view favoured by Baker be correct it implies that in *Zonitoides nitidus* we have an animal which, though belonging to an hermaphrodite group, has become more or less diœcious, a matter of great theoretical interest. And, in any case, it is clear that we have here a problem that merits further study. I have therefore examined the genital ducts of a large number of specimens

¹ Ibid., vol. 8, p. 421.

² *Monogr. L. and F. W. Moll. Brit. Is.*, vol. 3, p. 143.

³ *Proc. Acad. Nat. Sci. Phila.*, vol. 80, 1928, p. 38.

⁴ *Handbuch Syst. Weichtierkunde*, 1931, p. 594.

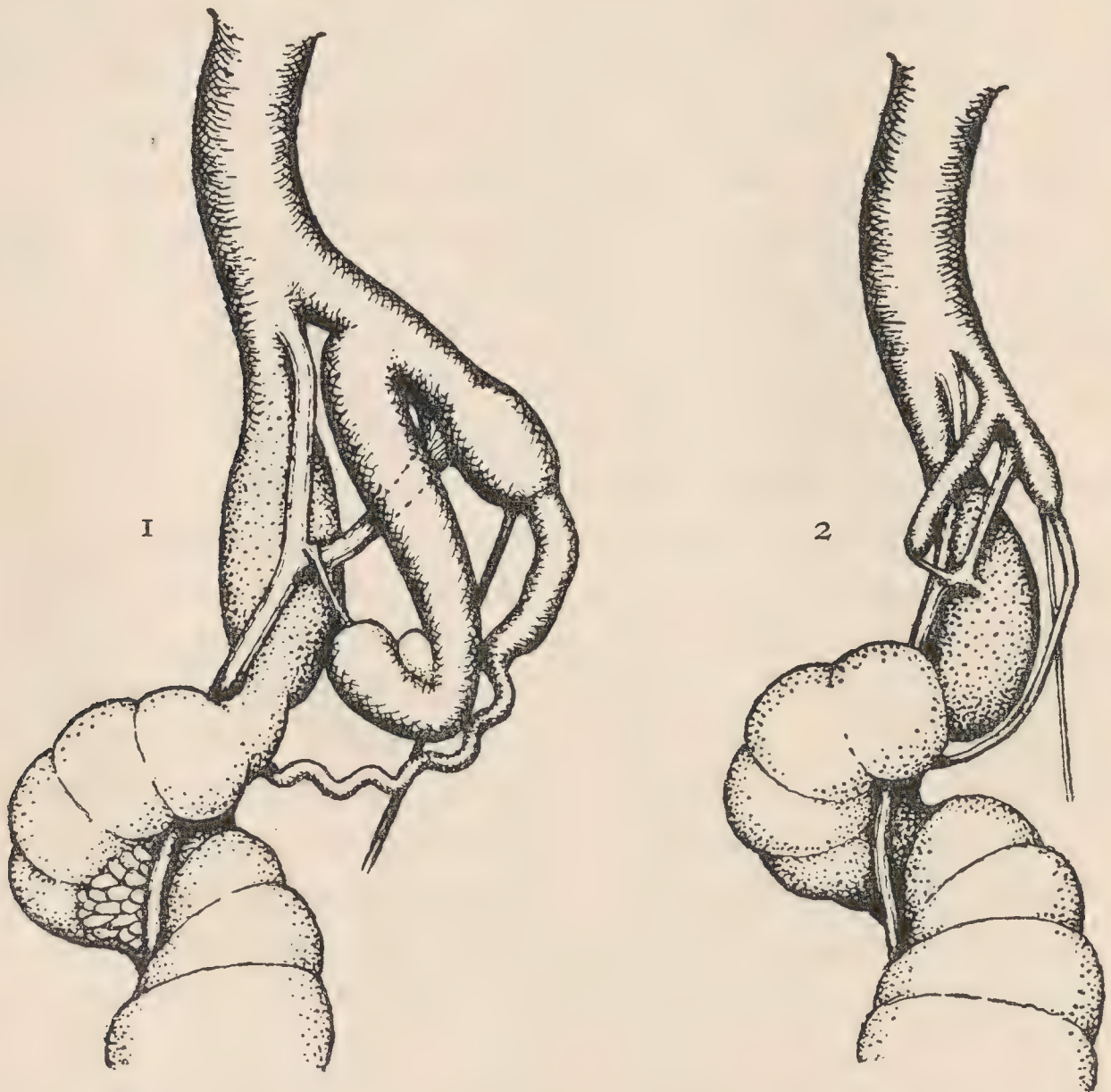
that I have collected in Cambridgeshire at different times of the year, and of a smaller number from Hertfordshire, Edinburgh, and Quebec, for which I am indebted to Professor A. E. Boycott and Mr. A. R. Waterston. Altogether 170 of the specimens dissected proved to be mature or nearly so, and of these 140 were found at Grantchester, about 2 miles south of Cambridge. They were collected in a broad ditch by the side of the road from Grantchester to Trumpington, where *Z. nitidus* occurs associated with the following species, although only the four marked with an asterisk are at all plentiful: *Lymnæa truncatula* (Müll.), **Planorbis leucostoma* Millet, **Carychium minimum* Müll., *Succinea putris* (Lin.), **S. pfeifferi* Rossm., *Cochlicopa lubrica* (Müll.), *Vallonia pulchella* (Müll.), *Arianta arbustorum* (Lin.), **Hygromia hispida* (Lin.), *H. striolata* (Pfr.), *Arion intermedius* Norm., *Euconulus fulvus* (Müll.), *Vitrea crystallina* (Müll.), *Oxychilus cellarius* (Müll.), *O. helveticus* (Blum), *Retinella radiatula* (Alder), *R. nitidula* (Drap.), *Agriolimax reticulatus* (Müll.), and *A. lævis* (Müll.).

My researches accord with those of earlier observers in showing that two strikingly different types of genital ducts occur among apparently mature specimens of *Zonitoides nitidus*. In one type (Fig. 1) the dart-sac is long and recurved posteriorly; it usually contains a long and slender dart, and when fully mature often bears a rounded coronal gland. The penis and epiphallus are also both well developed; the vas deferens pursues a more or less serpentine or zig-zag course; and the prostate gland is usually rather conspicuous. In the other type (Fig. 2) the dart-sac and penis are very much smaller and simpler. The slender, degenerate dart-sac is not usually reflexed posteriorly; it never contains a dart and never bears a coronal gland. The epiphallus is but little developed, being sometimes scarcely broader than the narrow vas deferens, which is straighter than in the other type. A prostate gland is not distinguishable; and probably owing to the small size of the penis the anterior end of the latter organ does not extend as far forward as in the other type, so that the genital atrium is somewhat longer.

But to term these two types male and female phases would seem to be misleading. Sections through the ovotestis, or hermaphrodite gland, of a specimen of each of the types, collected at the same time, show that in the so-called female phase the gland contains as many spermatozoa as it does in the so-called male phase, and, similarly, in the latter phase it contains as many ova as in the so-called female phase. Thus both types or phases are equally hermaphrodite. Moreover, I have found no appreciable differences in the female parts of the two types; the only essential difference lies in the organs connected with copulation. In the so-called male type these organs

are well developed in the manner normally found in most species of *Zonitoides*; in the other type or phase the organs of copulation are unusually small and degenerate.

The dimorphism of the genital ducts of this species may be compared with that which is found in *Vallonia*, *Acanthinula*, *Vertigo*, and allied genera. In these forms, however, adult specimens which have not well developed copulatory organs are entirely without them, the vas deferens ending blindly. This type has been appropriately termed the *aphallic* condition; and I therefore propose



Anterior half of genital organs of two specimens of *Zonitoides nitidus* (Müll.), from Grantchester, Cambridgeshire. $\times 20$.

FIG. 1.—Euphallic type.

FIG. 2.—Hemiphallic type.

to call the type found in *Z. nitidus*, in which the copulatory organs are present though very small and degenerate, the *hemiphallic* condition; while the so-called male phase, in which these organs are well developed, may be termed the *euphallic* condition.

In those orthurethrous species in which the aphallic type occurs it is usually more abundant than the euphallic type, and the same is true of the hemiphallic type in *Zonitoides nitidus*, a fact suggested by the observations of Ashford and Moss mentioned above, and confirmed by my own observations shown in the following table:—

<i>Locality.</i>	<i>Number of Specimens.</i>		
Grantchester, Cambs. (Aug., 1928–July, 1933)	32	euphallic,	108 hemiphalllic.
Lords Bridge, Cambs. (Oct., 1928)	0	„	1 „
Wall Hall, Radlett, Herts. (Oct., 1921)	2	„	6 „
Watford Road, Radlett, Herts. (May, 1923)	0	„	10 „
Duddingston Loch, Edinburgh (Oct., 1931)	0	„	6 „
Quebec, Canada (Oct., 1924)	1	„	4 „

The structural differences between the genital ducts of the two types or phases strongly suggest that snails of the euphallic type reproduce by cross-fertilization, and those of the hemiphalllic type by self-fertilization. But further investigations must be made before it can be said whether this is actually the case. Among all the specimens I have dissected the only four that contained a spermatophore, which might have come from another individual, were of the euphallic type ; but a microscopical examination of the contents of the spermatheca of a few specimens failed to reveal any spermatozoa in either type, though this fact is perhaps of little significance.

We must now consider whether the two types succeed each other during the individual's life, one changing into the other as the animal grows older, or whether some individuals are permanently of the one type and others permanently of the other type.

The view that the euphallic phase changes during the animal's life into the hemiphalllic condition, by the degeneration of the copulatory organs, is certainly untenable. This is shown by the fact that the shells of hemiphalllic specimens are, on an average, smaller than those of euphallic snails from the same locality. Thus, of the Grantchester specimens, almost half of those with shells exceeding 5.85 mm. in diameter proved to be euphallic, and scarcely a tenth of those with smaller shells, there being a difference of quite $\frac{1}{2}$ mm. between the average diameters of the shells of the two types.

The smaller average size of the hemiphalllic specimens, however, does not prove that this type changes into the euphallic phase as the animal grows. The difference may be due to the amount of room that the copulatory organs take up in the type in which they are well developed. And although the largest snails include the highest proportion of euphallic specimens, they also include some hemiphalllic examples ; indeed, the largest specimen that I dissected—an example from Lords Bridge, Cambridgeshire, with a shell measuring 7.3 mm. in diameter¹—proved to be of the

¹ Taylor (1908) and Ellis (1926) give the diameter of the shell of *Z. nitidus* as 8 mm., but this is far above the average size of the species. L. E. Adams (1896) gives $6\frac{1}{2}$ mm. as the shell's diameter ; Steenberg (1911) gives 5– $6\frac{1}{2}$ mm. ; Geyer (1927) 5–6 mm. ; Germain (1913 and 1930) and Mermod (1930) 5–7 mm.

hemiphallic type. It seems unlikely that such large hemiphallic snails are really younger and less fully grown than euphallic specimens that may be under 5.3 mm. in diameter.

But the chief argument against the view that the one type changes into the other as the animal grows older is that, if this were so, one would expect to find, at some seasons at least, not a few specimens intermediate in character; for so great a change in the copulatory organs could not be accomplished in a very short time, and it is very unlikely that the snail would hide itself underground during the whole period when it was taking place. Yet, as Moss has already pointed out, such intermediate or transitional specimens seem to be conspicuous by their absence. Among the numerous examples of *Z. nitidus* that I have dissected, only three small specimens from Grantchester might possibly have been regarded as intermediate between the two types, but as their shells only measured 4.2, 4.3, and 4.7 mm. in diameter respectively, it is much more probable that they were immature euphallic snails.¹ Among the 135 specimens from Grantchester more than 4.75 mm. in diameter, and the thirty from other localities, not one intermediate example was found; all were quite definitely of the one type or of the other, although both conditions were found together at all seasons of the year from March to October. It therefore seems almost certain that one type does not change into the other during the individual's life, but that some snails are permanently of one type and some of the other.

It is remarkable, however, that the relative abundance of the two forms varies at different times of the year, as Taylor noticed and as the table on p. 39 shows.

My observations indicate that in June and July, and sometimes also in May or August, the great majority of the specimens at Grantchester are of the hemiphallic type, and the very few euphallic snails found at the same time occur exclusively among the largest specimens. In the autumn, however, euphallic individuals become more numerous and are found of all sizes, while hemiphallic specimens become less common than at midsummer. The euphallic type is also common among such specimens as I have been able to find in the early spring. Thus it would seem that at Grantchester snails attaining sexual maturity at or near midsummer are of the hemiphallic type; while those of the euphallic type

¹ Probably the single "more or less intermediate" specimen dissected by Baker was also immature. He does not mention its size, but he states that his specimens lacked the coronal gland, and his drawing of the genital ducts of what he terms the male phase shows clearly that the specimen depicted was not fully mature.

become mature in the autumn, or sometimes perhaps not until the following spring, as probably little development takes place during the depths of winter. It is natural to suppose that at least some of the largest snails found in the summer are specimens that have continued to live on from the spring, and this would explain why a few of the euphallic type may still be found in the summer months.

Max. Diameter of Shell .	4.5-4.8 mm.	4.9-5.3 mm.	5.4-5.8 mm.	5.9-6.4 mm.	6.5-6.9 mm.	Total
2nd and 10th Aug., 1928 .	0	2 E, 5 H	1 E, 2 H	5 E, 3 H	0	8 E, 10 H
17th Oct., 1928 .	1 E, 1 H	1 E, 1 H	0	2 E, 1 H	0	4 E, 3 H
16th May, 1929 .	0	0	1 E, 0 H	1 E, 0 H	0	2 E, 0 H
3rd and 5th Aug, 1929 .	0 E, 1 H	0 E, 2 H	0 E, 3 H	1 E, 2 H	1 E, 1 H	2 E, 9 H
15th July, 1930	0	0 E, 1 H	0 E, 12 H	0 E, 3 H	1 E, 0 H	1 E, 16 H
17th Sept., 1930	0	0	2 E, 0 H	4 E, 2 H	2 E, 0 H	8 E, 2 H
25th Mar., 1931	0 E, 1 H	0 E, 1 H	1 E, 0 H	2 E, 0 H	1 E, 0 H	4 E, 2 H
13th May, 1931 .	0 E, 2 H	0 E, 9 H	0 E, 3 H	0 E, 1 H	2 E, 1 H	2 E, 16 H
30th June, 1931	0	0 E, 9 H	0 E, 13 H	1 E, 7 H	0	1 E, 29 H
13th Oct., 1931 .	0	0	0	0 E, 1 H	0	0 E, 1 H
7th July, 1933 .	0 E, 1 H	0 E, 2 H	0 E, 14 H	0 E, 3 H	0	0 E, 20 H
Total .	1 E, 6 H	3 E, 30 H	5 E, 47 H	16 E, 23 H	7 E, 2 H	32 E, 108 H

Table showing the number of euphallic (E) and hemiphallic (H) specimens of *Zonitoides nitidus*, of various sizes over 4.4 mm. in diameter, found together at Grantchester, near Cambridge, on different dates.

Various explanations might be suggested to account for this marked seasonal difference in the relative prevalence of the two types. It may be that snails of the hemiphallic type develop more quickly than the others, and arrive at maturity at least three months earlier. Or perhaps the two types lay their eggs at different times of the year, as might easily be the case if one type is cross-fertilized and the other self-fertilized. Or it is conceivable that the two types are not genetically distinct, but that all the individuals of this species inherit a tendency to become hemiphallic under certain external conditions. For example, it is at least possible that if the weather is cold and unfavourable at a certain critical stage in the early development of the genital ducts, the snail will become hemiphallic; while it will become euphallic if the weather is warmer at that stage of development, as it might be in specimens not maturing until late in the year.

Further observations and experiments are required to discover which explanation is correct. It will be noted that Taylor found,

as I have done, that the proportion of euphallic specimens diminished about the end of May ; but he does not seem to have found that it increased again in the autumn. Perhaps he did not examine many specimens in the autumn ; or it may be that in the North of England the euphallic snails do not mature until later. In this connection it may perhaps be significant that six specimens found by Waterston beside Duddingston Loch, Edinburgh, all proved to be hemiphallic, although they were collected as late as the beginning of October.

ZONITOIDES EXCAVATUS (Bean).

Charles Ashford¹ stated that out of a large series of individuals of this species examined in May, June, and July, scarcely 10 per cent furnished darts ; and that they were most likely to be found in animals with shells that had lost their brilliancy and assumed a dull, dirty yellow appearance. Moss² found that a dart was present in only three out of eleven, apparently mature, specimens of this species collected at Bardsley, near Ashton-under-Lyne, in March and April, that is to say, exactly the same proportion as he found in *Zonitoides nitidus* from the same locality ; and his further remarks, which I summarized when dealing with the last species, apply also to the present one. Taylor³ stated that adult specimens of *Z. excavatus* often contain darts up to the middle of May, but that later in the year darts are absent from mature examples, which then become less common, the immature specimens becoming more plentiful. Boycott,⁴ however, found darts in two out of five specimens he examined, which had been collected at Portmadoc, Carnarvonshire, in the month of August.

Of this species I have only been able to examine the genital ducts of between fifty and sixty specimens, including eight from English localities, for which I am indebted to Professor A. E. Boycott, thirty-seven from various Irish localities, nearly all of which were kindly collected and sent to me by R. A. Phillips, and eight from Holland, which were kindly collected by Dr. W. Beyerinck, and sent to me by C. O. van Regteren Altena. Particulars of these specimens are given in the following table :—

Hartfield, Sussex. March, 1926	3	hemiphallic specimens.
Burnham Beeches, Bucks. Feb., 1926	1	ditto.
" " " April, 1926	3	ditto.
Haltwhistle, Northumberland, June, 1925	1	ditto.
New Ross, Co. Wexford. Dec., 1929	2	ditto. (diam. 5.5 mm.)

¹ *Journ. of Conchol.*, vol. 4, 1883, p. 111.

² *Ibid.*, vol. 8, 1897, p. 421.

³ *Monogr. L. and F. W. Moll. Brit. Is.*, vol. 3, 1908, p. 136.

⁴ *Proc. Malac. Soc.*, vol. 11, 1915, p. 327.

New Ross, Co. Wexford. Jan., 1931	9	ditto. (diam. 4.7-6.1 mm.)
Mt. Butler, Roscrea, Co. Tipperary.		
Oct., 1929	9	ditto. (diam. 4.2-5.7 mm.)
Kilrush, Co. Clare. March, 1931	9	ditto. (diam. 4.5-6.0 mm.)
Woodford, Co. Galway. Jan., 1930	{ 1	euphallic (diam. 5.8 mm.)
	{ 6	hemiphallic (diam. 5.0-5.7 mm.)
Co. Galway. Sept., 1928	1	ditto. (diam. 5.2 mm.)
Mantinge, Drente, Holland. June,	{ 3	euphallic (diam. 5.2-5.8 mm.)
1934	{ 5	hemiphallic (diam. 4.9-5.8 mm.)

In this species we find exactly the same dimorphism of the genital ducts as in *Zonitoides nitidus*. The euphallic and hemiphallic types much resemble the corresponding types in the last species, and have already been figured by Moss.¹ They differ strikingly from each other in the same manner as they do in *Z. nitidus*. It is true that in some of the hemiphallic specimens of the present species the penis, epiphallus, and dart-sac do not seem to be quite so small and degenerate; but even these specimens do not approach those of the euphallic type, which contrast strongly with all the hemiphallic specimens found with them.

As in the last species, the shells of the euphallic specimens are, on an average, slightly larger than the others. But one, sexually mature, euphallic specimen had a shell measuring only 5.2 mm. in diameter, while the hemiphallic snails that I have dissected had shells varying up to 6.1 mm. in diameter, and Boycott² stated that the shell of the specimen of which he figured sections had a diameter of as much as 6.4 mm., although this animal appears to have been of the hemiphallic type. These facts, together with the notable absence of intermediate specimens, suggest that in this species also it is very improbable that one type develops into the other in the course of growth. It is much more likely that the slightly greater average size of the euphallic specimens is due to the fact that the much larger copulatory organs require a larger shell to accommodate them.

This species also resembles *Z. nitidus* in that the euphallic type is the less common of the two, but is not so scarce at some seasons of the year as at others. In the present species, however, according to the observations of previous authors as well as my own, it would seem that euphallic specimens are most frequently found in the spring or summer, and are rare at other times of the year. But it is to be hoped that some one who has the opportunity will investigate this matter further with the help of breeding experiments, which would be facilitated by the fact that it is often possible to distinguish the two types even in living specimens, owing to the transparency of the shell.

¹ *Trans. Manchester Microscop. Soc.* 1898, 1899, pl. v, figs. 23, 26.

² *Op. cit.*, p. 328.

OTHER ZONITIDÆ.

This remarkable dimorphism of the genital ducts does not seem to occur in any other member of the Zonitidæ found in the British Isles, apparently not even in *Zonitoides arboreus* (Say), a species introduced into Britain from America. Indeed, with the possible exception of *Agriolimax lævis* (Müll.), I do not know of any other British sigmurethrous snail or slug in which anything at all comparable has been found.

It is possible, however, that one or two of the numerous species of the Zonitidæ found only in America may show a similar condition. For example, in *Striatura*, an American genus allied to *Zonitoides*, Baker¹ has described and figured the genital ducts of *S. ferrea* Morse as having exceptionally small and simple male organs, and no dart, although he has shown² that in *S. milium* (Morse) these organs are large and well developed and a dart is present. It therefore seems possible that the three specimens of *S. ferrea* which Baker was able to examine may all have been of the hemiphallic type, for sometimes one may dissect as many as twenty examples of *Zonitoides nitidus* without finding a single euphallic specimen among them.

SUMMARY.

The two species of *Zonitoides* native to the British Isles both show a striking dimorphism in the genital ducts. In some specimens—the “euphallic” type—the penis, epiphallus, prostate gland, and dart-apparatus are well developed; in others—the “hemiphallic” type—these organs are quite small and degenerate—a condition which may be compared with that of the aphyallic specimens found in several orthurethrous species. Both types are equally hermaphrodite, but the first would seem better adapted to cross-fertilization, and the second to self-fertilization. They both may grow to about the same size, and may be found together at almost any season of the year without intermediate forms. It is therefore very unlikely that one type develops into the other during growth. Nevertheless, the euphallic type is often scarcest among small specimens, and is more frequently found at some seasons of the year than at others, when it may be comparatively rare. A similar genital dimorphism does not seem to occur among any of the other British Zonitidæ, although it may perhaps be found in one or two of the members of this family living only in America.

¹ *Proc. Acad. Nat. Sci. Phila.*, vol. 80, 1928, p. 37, pl. vii, fig. 6.

² *Ibid.*, p. 35, pl. vii, figs. 8, 9, 11.

ACHATINA FULICA (FÉR.) IN THE NETHERLANDS EAST INDIES.

By Miss TERA VAN BENTHEM JUTTING (Zoological Museum, Amsterdam).

(Read before the Society, 11th November, 1933.)

It is a matter of common knowledge that in the course of about 80 years the large African snail *Achatina fulica* (Fér.) has succeeded in finding its way from its native country, tropical Africa, to Mauritius, the Seychelles, British India, Ceylon, Malaya, China, and North Borneo, thus augmenting its territory in an unequalled short amount of time.

Benson was the first to meet them on Mauritius in 1847 and afterwards purposely introduced them in Calcutta, and by the time he published his note the editor of the journal could add a record from Reunion where the animal had also been introduced by human agency.

For further particulars about the rapid distribution of this snail in our century I may refer to the bibliography at the end of this note.

It is curious that in its native country *Achatina fulica* does not require special attention as a devastator, whereas in its new settlements it soon became an extraordinary plague to horticulture and to some of the crops for the world-market (rubber, tea, cacao) by feeding down young shoots and flowers, not even respecting such well-armed plants as *Euphorbia* and *Opuntia*.

Now it was not to be wondered at that the Plantquarantaine Service of the Netherlands East Indies of late years has been vigilant to keep this enemy far from our Malaysian colonies. Unfortunately, in spite of all precautions the barrier has been forced and in the beginning of 1933 specimens were reported from the Rhio Archipelago and afterwards from Java. A recent letter of Mr. van der Meer Mohr of the Deli Experiment Station at Medan mentions the occurrence of *Achatina fulica* in large numbers in a rubber plantation on the east coast of Sumatra.

Large new regions are hereby opened for the invaders. It is hoped that agricultural and horticultural authorities will succeed in combating this new pest by inculcating on the Europeans and on the native population that no measures of extermination can be severe enough to protect their crop from these voracious newcomers.

In concluding I wish to draw attention to a useful instruction for destroying *Achatina fulica* suggested in a paper by Connolly where it might perhaps escape adequate notice :—

"It is an interesting fact, in this connection, that there is no limestone in Ceylon, which is almost a purely granitic formation, and due doubtless to this cause the snails have developed a passion for whitewash, for which they crawl up the walls of buildings in order to lap it off the whitened windows, and this is now turned to account in keeping down the pest by placing little bags of poisoned whitewash in spots where they are likely to find and eat it."

This method of destruction might be put in practice in our colonies with equally satisfactory chances of success, at least in West Java, this part of the island being poor in limestone deposits.

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- 3.—V. H. C. JARRETT, "The occurrence of the snail *Achatina fulica* in Malaya" (*Singapore Naturalist*, 1923, pp. 73-6).
- 4.—F. W. SOUTH, "The Giant Snail (*Achatina fulica* Fér.) in Malaya" (*Malayan Agric.*, vol. 14, 1926, pp. 231-241).
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CEPHALOPODS FROM THE CAPE OF GOOD HOPE.

By K. H. BARNARD, D.Sc. (South African Museum, Cape Town).

IN rearranging the exhibited series of Cephalopods in the South African Museum, a specimen which had been labelled "Enoploteuthis" attracted attention. On closer examination it was found to be *Gonatus fabricii* (Lichtenstein). The specimen was captured by the Cape Fisheries Survey vessel *Pieter Faure* in 1903 off Cape Point in 930 fathoms (no closing net used), and probably had been provisionally identified as an *Enoploteuthis* by the late Dr. Gilchrist.

Gonatus fabricii was recorded from the Cape of Good Hope by Steenstrup, as mentioned by Pfeffer (1912, *Ceph. Plankt. Exp.* ii, F. a., pp. 231, 240, 242). This record seems to have been overlooked in compiling the fauna-lists of South African Mollusca.

The present specimen is in good condition but has lost the greater part of the epidermis. Length from anterior margin of mantle to posterior apex 220 mm., to beginning of fin 125 mm.; breadth 37 mm. Length of fin 95 mm., greatest breadth 85 mm. The fin is therefore nearly equilateral, the greatest width almost as far forward as the origin of the fin, the apex tapering rapidly to a slender point resembling Pfeffer's figure of *Ancistroteuthis* (l.c., pl. 10).

The 2nd, 3rd, and 4th (ventral) pair of arms are subequal, about 110 mm. in length, the 4th pair more slender than the others. The 1st (dorsal) pair is 90 mm. in length. Tentacles 160 mm. in length. On the club there are three small median hooks proximal to the very large subdistal one. Gladius 170 mm. in length. Radula as figured by Verrill (1882, *Trans. Conn. Ac. Arts Sci.*, vol. v, pl. 45, fig. 1a).

Pfeffer (l.c., p. 240) mentions differences between the northern and the southern (*antarcticus*) forms, and wonders whether Steenstrup's Cape specimen belonged to the latter or to an intermediate form. These differences are relative, and without actual material for comparison it is difficult to say to which form the present specimen bears most resemblance. In comparison, however, with Verrill's figure 1d on pl. 49 (l.c., 1882) both the distal and subdistal hooks on the club of the tentacle project much farther out of their sheaths, especially the large subdistal one, and in shape are almost perfect semicircles. This specimen would seem, therefore, to belong to the southern form.

This opportunity may be taken of placing on record the occurrence at the Cape of three other Cephalopods not hitherto included in the fauna-list.

Thysanoteuthis rhombus Troschel. The specimen from which the exhibited cast was made was washed ashore at St. James, False Bay, date unknown. Mantle length 480 mm., width 375 mm. Another specimen came ashore at the same locality in February, 1918.

Todarodes sagittatus (Lam.). A cast of this species was prepared from a specimen washed ashore on the west coast of the Cape Peninsula. Mantle length 520 mm., length of fin 235 mm., width of fin 390 mm.

Tremoctopus violaceus Della Chiaje. Two specimens of this species were washed up at St. James in April, 1912, and a third one at Somerset Strand (also in False Bay) in 1917.

CYPRÆA VINOSA GMELIN IN A SAXON WOMAN'S GRAVE IN SOMERSET.

By J. WILFRID JACKSON, D.Sc., F.G.S.

(Read before the Society, 7th December, 1932.)

I AM indebted to the Very Rev. Prior Horne, F.S.A., of Downside Abbey, near Bath, for information concerning a cowry-shell submitted to me for identification. The shell is that of *Cypræa vinosa* Gmelin and was discovered in a Saxon cemetery at Camerton, Somerset, by Prior Horne. It is pierced at one end for suspension and was found in grave 100 of this cemetery. The grave is dated as the middle of the seventh century A.D. and contained a female skeleton with the minute bones of a seven months child within the pelvis. In a little heap by the left foot of the skeleton were found: 1, cowry-shell; 2, lump of chalk cut in the shape of a heart, 1½ in. long; 3, a large boar's tusk; 4, a thick iron pin, 2½ in. long; 5, a flint scraper (?); and 6, a Roman 3rd brass apparently of Tetricus II.

In 1911 Tomlin (this *Journal*, vol. xiii, p. 251) recorded a lip-fragment of *Cypræa tigris* from a pit-dwelling at St. Mary Bourne, Hants. In 1912 (this *Journal*, vol. xiii, p. 307) I published a short account of the discovery of shells of *Cypræa vinosa* in Saxon graves in Kent. These shells, under the name of *Concha veneris*, were recorded by Faussett, in 1856,¹ from the graves of Saxon women, two on Kingston Down and one on Sibertswold Down. One of the Kingston Down graves is dated as seventh century A.D. from the associated pendants. I was able to identify the species from two examples preserved in the Mayer Collection in the Liverpool Museum. In the same paper I referred to another cowry from a double-grave, also seventh century, near Wingham, Kent, recorded in *Archæologia*, vol. xxx, p. 551.

In the *Antiquaries Journal*, vol. xi, 1931 (pp. 282-4), there is a further record by Mr. T. W. Bagshawe of the discovery of a *Cypræa vinosa*, pierced for suspension, in a Saxon grave at Luton, Bedfordshire, along with a female skeleton.

In addition to the foregoing, four other records of the association of cowry-shells with Saxon burials are mentioned by Nils Åberg in *The Anglo-Saxons in England* (1926, pp. 105 and 208). They are as follows: Chatham, Kent, one *Cypræa* found with a seventh century pendant; Sarre, Kent, one *Cypræa arabica*; Alfriston, Sussex, three fragments of a large cowry-shell, dating A.D. 550-600; and Haslingfield, Cambridge, one *Cypræa*. Cowries are also recorded from graves

¹ Faussett, *Inventorium Sepulchrale* (1856), pp. 68, 92, and 133.

at Linton, Cambs, of sixth century (see Fox, *Archæol. of the Camb. Region*, 1923, p. 260); and Burwell, Cambs (see T. C. Lethbridge, *Camb. Antiq. Soc.*, vol. xxix, pp. 84 et seq.); also Ellesborough, Bucks (see *Records of Buckinghamshire*, vol. ix, pp. 426 et seq., and plate i).

Cowries from Jutish burials from Breach Downs, Kent, and Wingham, Kent, are in the British Museum.

Nils Åberg (op. cit., p. 106, footnote) remarks that "Indian decorative shells also occur in Lombard, South German, and Scandinavian grave finds, and mostly belong to the seventh century. It would, however, seem that these shells had begun to be imported into Middle Europe already during the course of the sixth century".

In my 1912 paper (op. cit., p. 308) I refer to records of *Cypræa vinosa* from the Franco-Merovingian Necropolis of Nesles-lez-Verlincourt (Canton de Samer); from a sepulchre at Tardingen; and from excavations at Pompeii. *Cypræa tigris* has also been recorded from the latter place as well as from the Gallo-Roman necropolis of Trion, at Lyons. A fragment of *Cypræa lurida*, pierced for suspension, is recorded from the dolmen of Géandes, Bourg-Saint-Andéol, at Ardèche (see *Annales de la Société Linn. de Lyon*, vol. lviii, 1911, p. 210).

In my book, published in 1917,¹ I discussed the significance of the presence of cowries in graves and other situations. It was there stated that the cowry was (and still is) widely believed to confer fertility on women and to help in the process of parturition. They are worn by women as amulets, presented to them as bridal offerings in many places, and used by sterile and pregnant women to attain these respective benefits. In addition they have been placed in graves with the object of conferring vitalizing power and to ensure the continuance of the deceased's existence, i.e. not merely life but resurrection. The association of cowry-shells with pregnancy is to be found in places so far away as India and Japan.

¹ J. W. Jackson, *Shells as Evidence of the Migrations of Early Culture*, Manchester, University Press, 1917.

A REPUTED SMOOTH-SHELLED VARIETY OF *HELIX* *ASPERSA* MÜLL.

By C. OLDHAM.

(Read before the Society, 10th March, 1934.)

REFERENCE is made on p. 259 of vol. iii of J. W. Taylor's *Monograph of British Land and Freshwater Mollusca* to a variety of *Helix aspersa* said to have been described by P. Calcara as var. *glabra* in *Molluschi Sicilia* (1845). Mr. J. R. le B. Tomlin tells me that no such work as *Molluschi Sicilia* is known, but that in a paper of Calcara's, published in 1845, the *Esposizione dei Moll. Terr. e Fluv. dei Dintorni di Palermo*, ten forms of *H. aspersa* are enumerated.¹ No description is given of any, but the name *glabra*, one of the ten, should perhaps be regarded as a descriptive epithet. Lacking a diagnosis, however, it is a *nomen nudum*, and therefore invalid. In the absence of any proper description prior to 9th July, 1910, the date of issue of the relevant part of the *Monograph*, Taylor himself must be regarded as the author of *glabra* in view of his diagnosis, "Shell smooth with the usual rugulose sculpture almost obliterated"; locality, Sicily. In a later part of the *Monograph*, published on 20th December, 1914, Taylor ascribes to the Sicilian form which he had described as *glabra* a variety which "has been found to inhabit the churchyard at Rand, near Wragby, Lincolnshire, by Mr. J. F. Musham".

It seemed worth while to ascertain whether this smooth character was a heritable one, and in order to see if smooth snails still inhabited the churchyard, I visited Rand in January, 1933. At that season *aspersa* was, of course, not active, but a few dead shells found in the churchyard were of the typical wrinkled form. A subsequent examination of the shells from Rand in the Lincoln Museum, in the J. W. Taylor and J. Kidson Taylor collections in the cabinet of the Conchological Society and in Mr. Tomlin's collection, as well as shells in the Lincoln Museum collected in the Newark Road, Lincoln, on 20th May, 1910, a month later than the date on which the shells were collected at Rand, made it clear that the smoothness was not natural, but due to extraneous causes. All the shells were devoid of periostracum and fizzed when tested with a drop of dilute hydrochloric acid. But their degradation had gone further; the calcareous portion of the shells had apparently been attacked by some corrosive agent, which had so eroded the shell externally that the characteristic yellowish-grey

¹ The paper appeared in the *Atti della Accademia di Scienze e Lettere di Palermo*, N.S., vol. i (1845).

flammules had disappeared or were represented only by vestiges ; whilst internally the nacreous layer had the shabby appearance of shells some time dead. Smooth shells, replicas of those from the Rand churchyard, may be turned out to order by decorticating any ordinary *aspersa* by boiling them in dilute caustic soda, then partially decalcifying them by immersion in dilute hydrochloric acid and polishing the deteriorated product with a little vaseline. A like result may be achieved by immersing normal shells in sulphuric acid, which both decorticates and decalcifies them, although sulphuric breaks down the calcareous layers more slowly than hydrochloric acid.

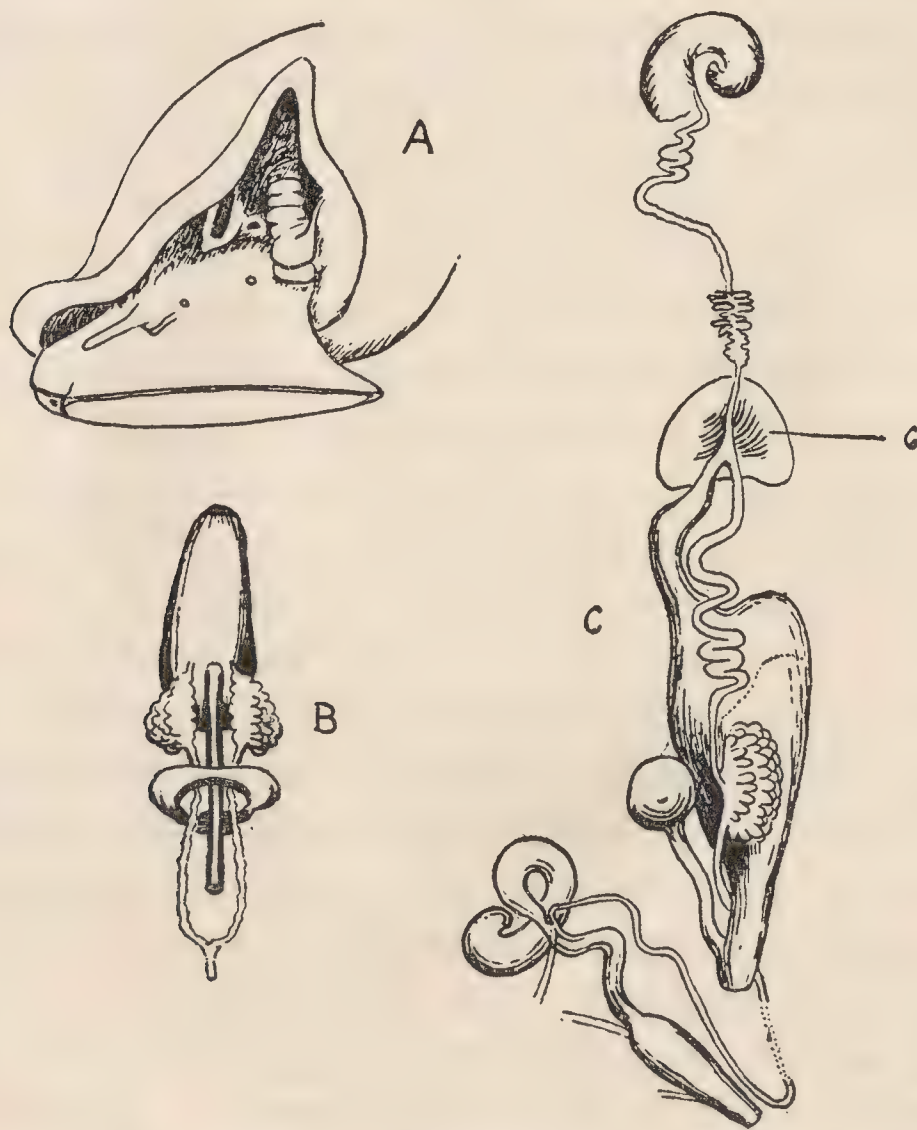
Mr. Musham tells me that the shells at Rand and in the Newark Road, Lincoln, were collected for and not by him, that those at Rand were found in a heap of old masonry in a corner of the churchyard, and that the smooth shells, whether at Rand or in the Newark Road, were all dead, such living ones as were seen being ordinary rough-shelled *aspersa*. How the Rand shells were reduced to their smooth state it is impossible to say. Attrition by blown sand, the effects of which are often seen in shells living on sand dunes, may be ruled out at once, for the churchyard stands on heavy glacial clay. Some of the Museum specimens appear to have remains of dead snails in their upper whorls, and it seems possible that snails, gathered in the churchyard or the adjacent vicarage garden, had been thrown into some corrosive stuff, weed-killer or what not, which had attacked the organic and inorganic parts alike, and had then been cast onto the rubbish heap, although this would hardly account for the smooth shells in the Newark Road. However the condition was attained, and whatever the shells referred to by Calcara may have been, it is certain that these Lincolnshire shells are not natural products and in consequence are not to be differentiated by their smoothness from normal examples. No such smooth form as Taylor's diagnosis postulates has yet been recognized in Britain.

ISIDORELLA PYRAMIDATA (SOW.) : A CORRECTION.

By DR. H. E. QUICK.

(Read before the Society, 12th May, 1934.)

IN the *Journal of Conchology*, vol. 19, June, 1933, fig. 12 on p. 327 is inaccurate. The organ shown as the gonad is really the albumen gland. The gonad occupies the upper whorls of the shell in the usual way, and the hermaphrodite duct has numerous small saccular diverticula as indicated in Fig. C. Compare Watson's figure of *Isidora (Physopsis) globosa* (Morelet), *Trans. Roy. Soc. of S. Africa*, vol. xii, part 3, plate viii.



In the living animal of *Isidorella pyramidata*, the lobulated respiratory frill overlaps the anus, and lies largely in front of it, hiding the siphon, but in spirit specimens the frill shrinks back and appears as in Fig. A, exposing the anus between it and the siphon.

While it is true that the salivary glands and their very short ducts lie in front of the nerve ring on the buccal bulb in *Isidorella* and in *Planorbis corneus*, a very thin thread of glandular tissue passes back through the nerve ring (Fig. B).

NAMES OF BRITISH MOLLUSCA—III.

By R. WINCKWORTH, M.A.

(Read before the Society 9th December, 1933.)

THE following remarks on *Pecten* and *Kellia* were included in Part II, but held over from the last number of the *Journal* for want of space. The note on *Pandora* has been amplified and the opportunity taken to add two other notes.

PECTEN (p. 241).

Grant and Gale in a book,¹ which contains a great deal of valuable systematic work, seem to me to be in error, when they regard the genus *Pecten* as established by Osbeck instead of Müller. Osbeck's account of his eastern travels was originally published in Swedish in 1757, and is too early to be taken into account; this was translated into German in 1765; and an English edition, translated from the German, appeared in 1771. The only reference to *Pecten* faithfully survives both translations, as may be seen from the complete quotations here given.

1757, p. 299. "Med ankartåget sölade et hwitt Corall-ämne, hwarpå en röd Snäcka, *Pecten adscensionis*, som hade många grenar på skalet och war fastväxt."

1771, p. 100. "With the cable we pulled up a piece of coral, on which a red shell (*Pecten Adscensionis*) was growing, which on its valves represented many branches."

While it is true that the German edition had been carefully revised, this does not give nomenclatorial validity to the original names. Opinion 21 of the International Commission on Zoological Nomenclature refuses nomenclatorial status to Klein's genera of 1744 as quoted by Walbaum in 1792. Opinion 57 is even more pertinent:—"Hasselquist's 'Iter Palaestinum' was published prior to 1758; it was edited as to its nomenclature by Linnaeus. The German translation by Gadebusch, published in 1762, does not give validity to the names published in the original edition in 1757."

Not only is *Pecten* Osbeck inadmissible on this basis, but it would also appear to be a *nomen nudum*. The genus is in no way described, but is solely dependent on its association with the specific name *Adscensionis*. This species, however, is certainly not indicated² or defined, and surely one cannot regard this casual allusion as a description. It is so far from being described that Grant and Gale interpret it as an unidentified species of *Chlamys*, while I should

¹ *Mem. San Diego Soc. N.H.*, vol. I (1931).

² The term "indication" is precisely defined in Opinion 1.

consider it more probable that it was *Spondylus powelli* Smith, after consulting published and manuscript lists of Ascension Island mollusca and bearing in mind the remark, firmly grown (fastwäxt) on coral; though an unknown species of *Chama* might be a better guess. This point could be settled from the actual specimen, which is probably still in existence, but "in no case is the word indication to be construed as including museum specimens."

My conclusion is that *Pecten* Osbeck is a nude name, published in a work not valid for nomenclature; accordingly *Pecten* Müller 1776 stands with *P. maximus* (L.) as type.

KELLIA (p. 242).

Grant and Gale have stated that the customary use of *Kellia* is inadmissible, inasmuch as Herrmannsen in 1846 selected *Cardium rubrum* Montagu as type. They have, however, overlooked the earlier designation of type by Récluz in 1844, who, in his account of *Erycina*, refers¹ to Turton's genus *Kellia*, mentioning "Le type de son *Kellia*, celui seul qui correspond au caractère de son genre, le *Kellia suborbicularis*."

CALOPODIUM v. PANDORA (p. 248).

Dr. Prashad has already pointed out, in his report on the Pelecypoda of the Siboga Expedition (p. 322), that *Calopodium* must supplant *Pandora*.

The first reference to *Pandora* occurs in 1795, in volume 11 of the *Conchylien-Cabinet*, where (p. 211) Chemnitz at the end of his description of *Tellina crystallina* states that Hwass had made a new genus (Geschlecht) for Tellinas with a flat upper valve such as *inæquivalvis*, *crystallina*, etc., and called it *Pandora*. Unfortunately in this volume Chemnitz is as casual in his use of binomials as in the earlier volumes²; and I do not see that the quotation of a name attributed to Hwass in a non-binomial work can be regarded as a valid proposal of a genus.

The next use of the word *Pandora* is as a legend over three figures in the middle of plate 250 of the *Tableau Encyclopédique*, part 19, published in 1797. Unfortunately no specific name is given; and, although a published figure is to be construed as a valid indication of a species, it does not give validity to a generic name.³

Thus *Pandora* cannot be regarded as a valid generic name until Lamarck's formal description⁴ in 1799. Meanwhile, Röding had

¹ *Revue Zool. Cuv.*, vol. 7, p. 295.

² There is a monomial *Citharædus* on p. 297; numerous trinomials, e.g. *Helix Ianus bifrons* (p. 307) and *Helix Nux denticulata*, *Helix sinuata major* (p. 275), and even quadrinomials occur in this volume.

³ International Rules of Zoological Nomenclature, Opinion 1.

⁴ *Mem. Soc. H. N. Paris*, an vii, p. 88.

already in 1798 proposed *Calopodium*¹ for the species *C. albidum* Röding = *Tellina inæquivalvis* Gmelin.

Poli in 1791 placed the animal of *Tellina inæquivalvis* in a new genus, *Hypogæa*; but that name need not be considered here, as it includes *Pholas dactylus*, which species was selected as type by Gray.

I cannot agree with those authors who regard the Mediterranean and Atlantic forms referred to *Pandora inæquivalvis* (L.) as conspecific. The English species has a thick shell, the Mediterranean a thin one; they differ also in colour, in shell proportions, in muscle scars, in the shape of the cardinal and in the angle it makes with the ligament. It is true both vary considerably, but they remain distinct in these and almost every shell character except sculpture. For these two forms the names usually given are *inæquivalvis* Linné and *margaritacea* Lamarck. I have recently re-examined the type specimen in the Linnean cabinet, and can confirm that it is the Mediterranean species. For the Atlantic species, I am afraid the law of priority requires us to revive *albidum* Röding 1798 for *margaritacea* Lamarck 1801. *Calopodium albidum* is defined by reference to *Tellina inæquivalvis* Gmelin (which includes Pacific, Mediterranean, and Atlantic species) and further limited by the quotation of Chemnitz's figures only among those given by Gmelin: this makes *albidum* the Atlantic species.

TELLINA BRITANNICA Tomlin (p. 245).

Attention is here drawn to a recent paper² in which this new species is described. It is closely related to *Tellina balaustina* L., and should be added to the list after No. 121.

SCALA Bruguière.

I note that Thiele in his *Handbuch*, p. 222, revives Klein's name *Scala* for *Epitonium*, quoting it as *Scala* (Klein 1753) Bruguière 1792. I find that Bruguière, however, has not used *Scala* himself, but in the article on the history of conchology, section "Méthode de Klein", gives a list of Klein's genera extracted from his *Tentamen*. This (p. 532) is the only reference to *Scala* I can find in Bruguière, and obviously does not make Klein's name available; the description of *Scala* is quoted verbatim from p. 52 of the *Tentamen*. In *Epitonium* the whorls are separated so as to form a disjunct spiral, and I have regarded *Clathrus* as generically distinct.

¹ *Mus. Bolten.*, p. 166.

² *Proc. Malac. Soc.*, vol. 21, p. 145 (1934).

BIONOMICS OF A BRACKISH-WATER NUDIBRANCH : *LIMAPONTIA DEPRESSA*.

By DR. PAUL PELSENEER.

I. GEOGRAPHICAL DISTRIBUTION.

IN the 8th part of Alder & Hancock's *British Nudibranchiate Mollusca*, 1910, p. 142, Eliot says that *Limapontia depressa* "appears not to have been found since the time of Alder & Hancock" (1862, *Ann. and Mag. Nat. Hist.*, ser. 3, vol. x, pp. 264-5), and thus has remained unknown from other localities than those quoted by them: near Sunderland, North Sea, and near Swansea, Bristol Channel.

Nevertheless, in some other stations, *L. depressa* was recorded before 1910: in Wimereux, near Boulogne (Pelseneer, 1894, *Mém. Acad. Belg.*, vol. liii, p. 62: anatomical description, without biological account), and near Easington, Yorkshire (Petch, 1903, *Trans. Hull Sci. and Field Natural. Club*, vol. iii, p. 32); then, more recently, in Sallenelles, not far from Caen, Calvados (Gallien, 1929, *Bull. Soc. Linn. Normandie*, ser. 8, vol. i, p. 162), and in East Scotland, near Dunbar (Kevan, 1934, this *Journal*, vol. xx, p. 16).

Thus this species enjoys a rather wide distribution in both Britain and Continent (French coasts of the Channel), and as *L. depressa* is a minute creature, it has probably escaped notice in various places; but as it has a very special habitat, it could not be present everywhere.

II. HABITAT OR BIOTOPE.

In each station *L. depressa* is living in the same natural conditions: brackish pools more or less isolated from the sea, and there related only by exceptional tides.

It has also, in its various places, the same fellow-species, viz., among mollusca: *Tellina balthica*, *Hydrobia ulvæ*, *Alexia myosotis*, and often *Alderia modesta*.

Adult and larval *L. depressa* may live in sea-water, and the latter could be carried eventually by currents through the open sea. In fresh water, on the contrary, they die. Besides, *L. depressa* lives also, for a rather long time, out of the water, in a damp atmosphere.

III. BREEDING HABITS AND DEVELOPMENT.

(1) *Breeding Season*.—Not only during the months November–December, then once more April–May, but also in January–February (Gallien) and March (Pelseneer). Thus during a very large part of the year, over seven months.

(2) *Egg Clusters and Number of Eggs*.—The nidamental ribbons or egg clusters are as long as the laying animal, 6–7 mm., sometimes more (1 cm.). The deposition of a cluster ends in a few minutes. The number of eggs in a ribbon is about 400, or nearly the same number as in *Limapontia capitata* in the Mediterranean Sea (Vayssi re, 1903).

(3) *Development*.—A. Conformation of the hatched young. The Limapontiidae are the only family of Nudibranchs where the young of some genera hatch with the adult form (“ephelicismorphic”): *Cenia cocksi* (Pelseneer, 1899; Colgan, 1912), *Vayssierea caledonica* (Risbec, 1928). In *L. depressa* the hatching, as could be expected from the great number of eggs, takes place with veliger free larv e, as in the adjoining species *L. capitata*, and in other genera of Ascoglossa: *Ercolania*, *Herm ea*, *Alderia*, *Elysia*.

B. Length of embryonic life: in *L. depressa* this period covers three or four weeks, thus more than in *L. capitata* (16–17 days). In the latter, however, observations were made in summer (June) and in *L. depressa* in winter (February), and the different durations are caused by the differences of season: always higher temperature accelerates development and hatching.

OCCURRENCE OF AMNICOLA TAYLORI (E. A. SMITH) AND BITHYNIA LEACHII (SHEPPARD) IN SCOTLAND.

By RODGER WATERSTON.

(Read before the Society, 8th April, 1933.)

A VISIT was paid to the ponds used for seasoning timber at Grangemouth, Stirlingshire, on 20th April, 1931. The ponds are three in number. The two largest lie right and left of the road Grangemouth to Falkirk at Grangemouth and communicate under the road, while that on the right also communicates directly with the Forth and Clyde Canal and with the River Forth at high tide. The third pond lies close to this one and does not concern us in these notes.

The two main ponds are bordered, where they have not been artificially built up with cement, by a narrow belt of *Glyceria aquatica* backed by *Urtica* in places. *Amnicola taylori* was found to be common amongst the submerged decaying leaves at the roots of the *Glyceria*. Specimens were readily obtained by sieving. On the outer fringe of the *Glyceria* belt *Bithynia leachii* occurred abundantly with *S. corneum* and *B. tentaculata*. Many egg ribbons of *B. leachii* were observed in both ponds on a subsequent visit on 7th July, 1931.

Amnicola taylori has been kept under observation at home and

bred in June last year, producing small circular plano-convex capsules laid singly and each containing a single egg. Further observations on the development have confirmed those of Jackson and Taylor (*Journal of Conchology*, xi, pp. 9-11). The close parallel of the habitat of this species at Grangemouth and Dukinfield is remarkable. In both cases *Glyceria* seems to furnish most amenable conditions.

Elsewhere in Britain *A. taylori* occurs in canals in Cheshire and Lancashire.

Ellis regards the species as North American. In order to obtain more detail on the somewhat doubtful home of this species specimens were sent to Dr. H. A. Pilsbry. In his reply (15, vi, 31) he states:—

“This shell is not known in North America, and is not much like any of our forms. It has the appearance of the European group. So far as I know, the statement of A. E. Ellis in *British Snails*, page 81, that ‘*A. taylori* is a North American species’ is erroneous. I may say that our collection contains practically every North American species known.

“Your shells seem to agree well with the account of *taylori* E. A. Smith, but I have not been able to compare Dukinfield specimens, by which that form is to be judged, as that is Smith’s type locality (*Journal of Conchology*, xi, p. 9).¹

“I do not think that Amnicolidæ are likely to be transported on pine logs, though it is of course possible. At all events, we have nothing closely resembling your shells in America.”

This then destroys the North American myth. Where is the true home of *taylori*?

Stelfox (*Proc. Roy. Ir. Acad.*, xxix, B, p. 69) regards it as endemic. Its only habitats in Britain, however, are artificial and it seems more likely that it is a European introduction.

Bithynia leachii occurs sparsely in the Forth and Clyde Canal at Grangemouth as well as in both of the ponds mentioned. The occurrence of this species in Scotland must also be regarded as adventitious.

The chief pond weeds at Grangemouth were *Potamogeton* spp., *Ceratophyllum*, *Lemna polyrhiza*. Associated mollusca were *Planorbis vortex*, *P. spirorbis*, *P. albus*, *P. contortus*, *Physa fontinalis*, *Limnæa peregra ovata*, *Valvata piscinalis*, *V. cristata*, *Bithynia tentaculata*, *Sphærium corneum*, *S. lacustre*, *Pisidia*.

¹ Through the kindness of Professor Boycott I have been able to compare the Grangemouth shells with those from Dukinfield. The Scottish shells agree in every detail with the English specimens.

GIANT FORM OF PLANORBIS CORNEUS (LINNÉ).

By LIONEL E. ADAMS.

(Read before the Society, 7th December, 1932.)

SEVERAL years ago Professor Boycott discovered at Burgh Heath, in Surrey, two contiguous ponds containing a giant form of *Pl. corneus*. Within more recent years I have had the opportunity of studying these ponds, and have come to the conclusion that the snails are not merely a number of individuals specially favoured by an abundance of food under good growing conditions, but that they form a constant variety if not race. The following facts seem to support this view.

1. There are no individuals of normal size to be found in the ponds; no adult measuring less than 33 mm., though within half a mile there is a swamp containing plenty of normal specimens; also a pond a mile and a half distant with normal specimens. These are the only habitats of *Pl. corneus* in the district, the nearest being at Guildford and Wimbledon.

2. Comparison of their "growth checks" shows that after the first year the Burgh Heath individuals are consistently larger than normal specimens.

	<i>Burgh Heath.</i>	<i>Normal.</i>
1st year	9-13 mm.	9-13 mm.
2nd year	26-30 "	22 "
3rd year	34 "	24 "
4th year	35 " (a few 36 mm.)	25 " (rarely 26 mm.)

These "growth checks" are those of a year's normal growth, and not those due to periods of drought or other causes.

3. These larger individuals, as might be expected, lay larger batches of eggs, and I think, though I have not actually measured, that the individual eggs are likewise larger than those of normal-sized parents. I have had in my jars capsules containing 60 (four times) and several containing over 50 eggs. C. Oldham tells me his normal sized captives do not lay more than 50 in a batch, 49 being the highest of his records.

4. I have never known the "giants" to pair with normals in my jars, though every opportunity was given them. This, however, is merely negative evidence, and there is no saying if this would be the case if they met in a wild state.

There is of course the possibility of the Burgh Heath form being imported from the Continent, as there are specimens of equal size from Budapest, and some 34 and 32 mm. from the "Rhine" in the Darbishire collection in the Society's collection in the Manchester Museum.

5. While *Pl. corneus* greatly preponderates in numbers, the following species are also found in the ponds, all being of normal size with the exception of *P. obtusale* which is larger than usual: *Pl. carinatus*, *Pl. contortus*, *Pl. vortex*, *Pl. complanatus*, *Sph. lacustre*, *Sph. corneum*, *L. peregra*, *A. lacustris*.

The soil is sand and gravel, and the ponds are deeply lined with black mud. *Potamogeton natans* and duck-weed cover nearly the whole surface. There is a marked lack of carbonate of lime in the water and most of the adult *corneus* are eroded characteristically of that deficiency. It is difficult, therefore, to imagine that the *corneus* would be specially favoured by their environment. The ponds are shown in a map of the district dated more than a hundred years back.

A NEW SPECIES OF LUCINA.

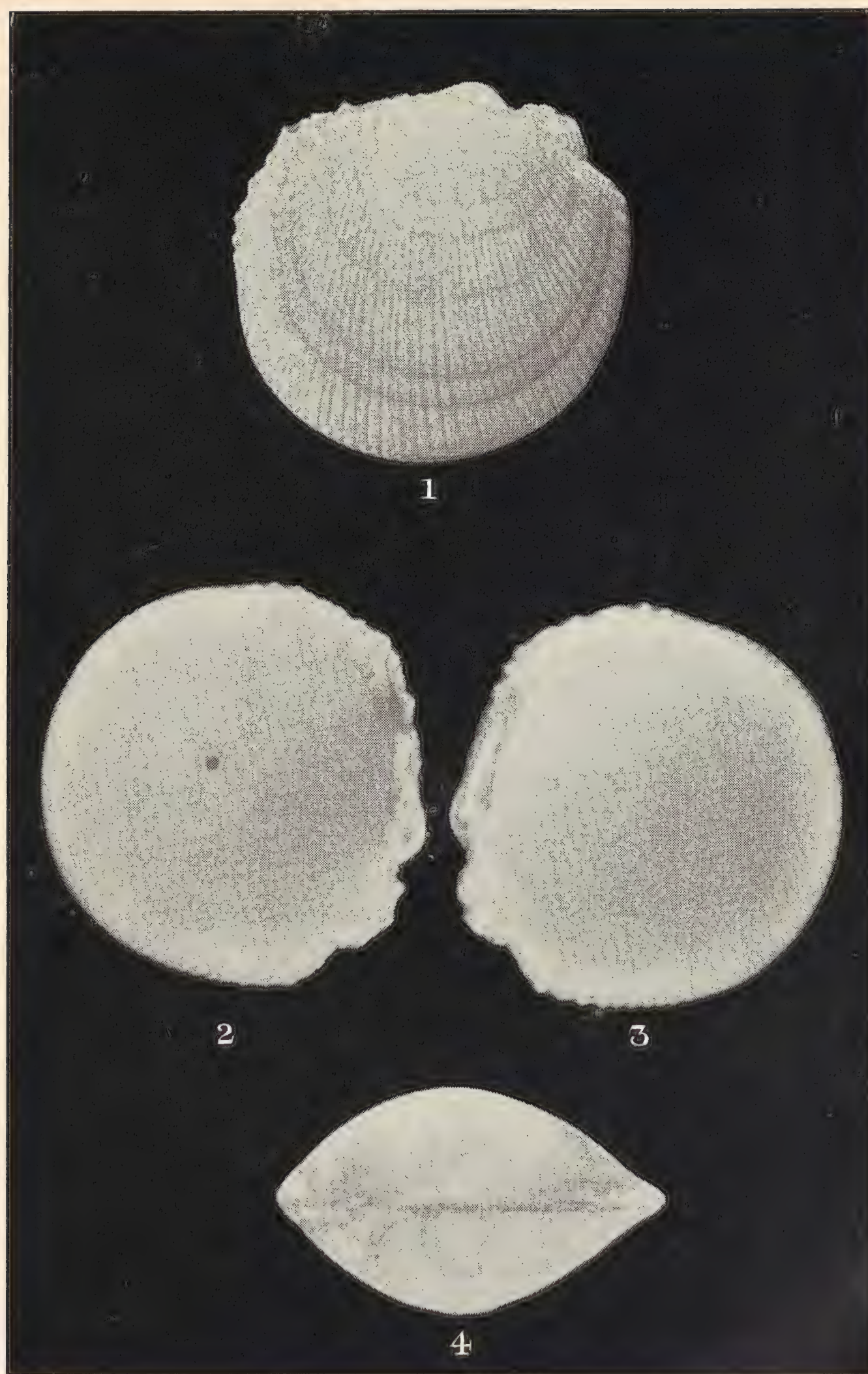
By A. E. SALISBURY.

[PLATE I.]

SOME years ago Mr. H. W. Worsfold received from Sarawak some specimens of a lucinid shell which he asked me to identify, and of which he very kindly presented me with an example.

On studying the Lucinidæ in the National Collection the shells were found to be identical with a species until now without name; this I propose to call *Lucina odontotis* in reference to the very marked and dentate ear over the anterior side of the beak which distinguishes the species. The following is a description of the shell, the type of which is in the British Museum, and is now figured.

Lucina odontotis sp.n. Shell equivalve, suborbicular, subequilateral; the anterior side of the umbonal region is furnished with a very distinct ear with toothed surface; the entire surface of the shell is covered with marked radial sculpture strongest in the posterior region, becoming finer in the centre, and strengthening again at the anterior side; the ribs are crossed by concentric striation, giving the effect of tiling, especially when viewed under the lens, this imbricate effect developing into a frilling in the posterior region. Ligament contained in a groove, the outer edge of which is dentate to the extent of becoming frilled as above mentioned. Internally the pallial line joins the adductor scars. Denticulate all round the inner margin, the dentation having a tendency to become obsolete in the posterior region, but nevertheless quite obvious. Colour white, tinged with ochre; texture of a semi-porcellanous character. The type and two other shells in the British Museum were collected at Sarawak and presented by Sir George Bartlett.



LUCINA ODONTOTIS SP.N.

Fig. 1 : External view of right valve.
Figs. 2, 3 : Internal view of shell.
Fig. 4 : Dorsal view.

[Facing p. 58.]

LIMNÆA PEREGER Müll. Var. MARITIMA Jeff. AT
GULLANE POINT, FIRTH OF FORTH.

By D. K. KEVAN.

(Read before the Society, 7th December, 1932.)

THE above variety of *L. pereger* occurs in some abundance in the ponds at Gullane Point, Firth of Forth (Bartholomew's half-inch map). These ponds lie in hollows just off the sand-dunes proper, and are choked with mosses, etc., while in one the Bogbean (*Menyanthes trifoliata*) occurs. They frequently dry up during the summer months, retaining sufficient moisture under the moss to ensure the survival of the molluscan fauna.

I first found the variety in 1929, and took further specimens in May, 1930 and March, 1931, but beyond the normal interest attaching to this variety, there was nothing unusual about it, either in form or size (Fig. 1). In August, 1932, however, the ponds were dry, and among those of normal type I found a *Valvata*-like monstrosity, an empty shell (Fig. 2). The likeness to *V. piscinalis* is very evident when the shell lies on the ground and is viewed from above, owing to the exceptionally flattened spire and subrotundate aperture, but is less apparent from the front where its Limnæid form (although distorted) is revealed. It is not unlike some of the "half-flats" (but dextral, of course) to which Professor A. E. Boycott and Captain C. Diver refer in their paper on the abnormal forms of *L. peregra* obtained in artificial breeding (*Proc. Malac. Soc. Lond.*, vol. 19, Nov., 1930, pl. 15). Its texture tallies with that of normal specimens. The shells taken from this particular pond varied considerably in size, but rarely exceeded that given by Ellis (*British Snails*, p. 106), $11 \times 5\frac{1}{2}$ mm. I only took empty shells (the snails having died after breeding this year), but the new brood was plentiful and well developed.

In the second pond, apart from a certain amount of normal variation in the shape of the aperture and length of spire, I encountered nothing unusual, but in size, the shells were exceptionally large, shells of over 15 mm. in length being common, while some exceeded 20 mm. in length. These were lying on top of the dried moss. Underneath, the new brood was developing as at the first pond. It is possible that years of exceptional growth are cyclical, as on the previous occasion that specimens were taken from this pond (31st May, 1930, when the species had fully or practically attained maturity) only a few shells were slightly above normal size.

Associated with *L. pereger* var. *maritima* were *Lim. truncatula* and *Pisidium personatum* (both abundant) while *Plan. crista* was sieved on the 1931 visit. *Vallonia pulchella* (*fide* Kennard) in subfossil form

was plentiful in the sand under the dried moss of these ponds, and one shell of *Agriolimax agrestis* was also found in this situation. It is interesting to note that in the marshes (about half a mile to the south of these ponds) which extend practically to the shore, and contain a considerable and interesting molluscan fauna, *Lim. pereger* var. *maritima* does not occur, its place being taken by the typical form.

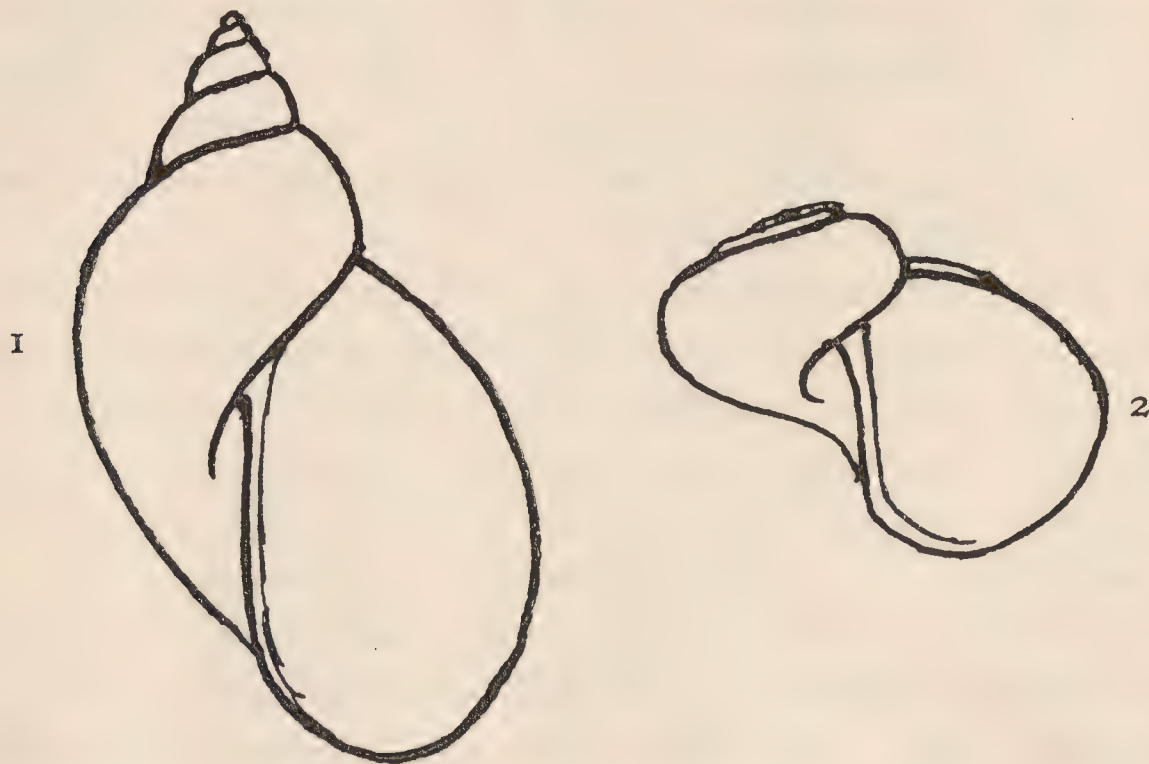


FIG. 1: *L. pereger* var. *maritima* 12 × 7 mm.

FIG. 2: *L. pereger*, var. *maritima* monstr. 5 × 5 mm.

Supposed New Variety of *Melanopsis doriæ* Issel.—*Melanopsis doriæ* Issel, var. *nigra* nov. Shell uniformly black, sub-sutural band wanting, columella lip bluish with a blue prominence on the body whorl where the outer lip joins. Habitat: Qanat at Ginehkan (c. 6,000 feet), near Kerman, S. Persia. Type in my collection; paratypes in British Museum. I first found this variety in 1924, but being in the very early stages of my study of the mollusca of Persia I did not describe it as new and only do so now with some hesitation. One is loth to add more names to the genus *Melanopsis*, but I have now travelled fairly widely in S. Persia where this species is, perhaps, the commonest shell found. I think the occurrence of the variety is worth recording. A qanat is an underground watercourse made by sinking a series of wells and joining the bases. After some distance the water flows out on the surface as a stream. It is just at this point where shells are nearly always found, sometimes in great profusion. This qanat at Ginehkan (pronounced "Geenehkoo" by the natives) comes out of the mountain side and flows for 550 yards until it joins another swift stream coming down from the mountains above. From this point on no shells occur; the combined streams dash along over stones in a headlong rush to the plain below, where the water is distributed over cultivated land. There is no connection with any other body of water. Throughout its length this qanat contains enormous numbers of the variety described, only a very small percentage in any way approaching the normal *doriæ*, which is dark brown with a light brown or yellow sub-sutural band. So far I have not found this variety anywhere else in S. Persia. I collected a large number of normal *doriæ* in a qanat to the west of Kerman, and of these just a few show some tendency to darkness and loss of the band, but can be easily separated from var. *nigra*.—H. E. J. BIGGS (*Read before the Society, 11th November, 1933*).

THE COLOURATION OF *NUCELLA LAPILLUS* (L.).

By GUY L. WILKINS.

(Read before the Society, 16th September, 1933.)

A SHORT time ago a note on the colouration of *Nucella lapillus* (L.) was read before this Society. This aroused my interest, for this summer I have added considerably to my series of the species, principally from the pier-head at Deal. Mr. Burton mentions in his paper¹ that on clay rocks the shells of *Nucella lapillus* are usually white with brown bands and on limestone or granite rocks may be more varied in colouring. I have found several other colour varieties, in addition to those mentioned by him, living on Deal pier-head. The rocks from Deal to Dover are all chalk mixed with flints; I have not observed any granite, limestone or clay. The supports of the pier (which are sunk into the chalk sea floor) are all of iron, including the steps. There are a few baulks of timber at the very end of the structure, bolted to the iron supports to act, I suppose, as shock absorbers. The girders, spans, and steps are richly covered with barnacles and mussels, which, I believe, form a large part of the diet of *N. lapillus*; the evidence of many a meal may be seen about, in the shape of empty mussel shells still hanging by the byssus. Jeffreys² notes having seen it busily feeding on *Balanus*, the proboscis being inserted between the opercular valves.

The under parts of the iron steps, which are of a lattice formation, are in great demand for the laying of egg clusters, as indeed are the angles of the girders; it is practically impossible to remove a complete mass, so strongly are they attached to the surface. The molluscs have been careful in almost every case to choose a spot comparatively free from mussels and barnacles. This cautious egg laying is no doubt in part responsible for the abundance of *Nucella lapillus* on Deal Pier.

It may be of interest to note here the colour varieties obtained from this one locus:—

(1) *Pure white—no bands.*

(1a) Pure white with spire light brown (possibly due to rust marks?).

(1b) White with sienna brown bands.

(1c) White with pale chocolate brown bands.

(1d) White with dark chocolate brown bands.

(1e) White with the shell grooves alternately light brown.

¹ *Journ. of Conch.*, vol. xix, 339.

² Jeffreys, *Brit. Conch.*, vol. 4, p. 279.

- (1f) White with the three wide bands composed of alternate narrow ones of buff and pale brown, sometimes scarcely visible outside but dark inside.
- (2) *Yellow or buff—no bands.*
 - (2a) Yellow or buff with similar banding to those with the white ground.
- (3) *Orange—no bands.*
 - (3a) Orange with chocolate brown bands.
- (4) *Pale brown—no bands.*
 - (4a) Pale brown with waving longitudinal lines of dark brown.
- (5) *Dark chocolate brown—no bands.*
 - (5a) Dark chocolate brown with single white band round suture.
- (6) *Olivaceous*, slightly clouded with brown.
- (7) *Pale mauve—no bands.*

This latter form is particularly fine when young, although the colour is a trifle illusive. The shell is pale mauve all over, the mouth rose colour at the lip, shading back to a rich red-brown. As the shell advances in age, it apparently becomes denser and loses the delicate shade. By artificial light the colour is scarcely distinguishable from the somewhat dull grey of a mature specimen.

I have found no specimens exhibiting a *definite purple or red*. The deepest orange forms by no means approach the true red seen in *Littorina littorea* L.

All the colour varieties enumerated above are fairly frequent with the exception of 1e, 5a, 6, and 7. White, no bands, did not appear to be very much more in evidence than the coloured forms.

Although the Deal shells must be exposed to a certain amount of rough sea, they are of a notably good shape and attain quite a considerable size.

The largest I have taken from Deal Pier is 43 mm. in length; dead shells as large as 50 mm. are fairly frequent further along the coast at Sandwich and Shellness. Whether these have been carried along from Deal is difficult to say, but it may be quite likely, for I found a solitary ancient specimen living in a pool left by the tide on the Sandwich side of Pegwell.

One would not expect to find *Nucella lapillus* thriving in such a spot in any quantity, for there are no rocks nearer than Ramsgate, between which place and Sandwich is the outflow of the River Stour.

The Deal specimens are fairly strongly ribbed in most cases, the young usually foliated, these foliations often continuing to quite a late stage of growth.

No strong tuberculations of the outer lip were noticeable in the

specimens collected in the summer, but some sent to me in March of last year, of a smaller size, exhibited this feature to a marked degree.

I have collected the species at Walton-on-the-Naze (Essex), Felixstowe (Suffolk), and Folkestone (Kent), and in addition I have acquired specimens from the River Blackwater (Essex), Hastings (Sussex), and Pendine (Cornwall).

None of these call for very particular notice, except that the Folkestone shells (which were living on rocks in some profusion) had strongly tuberculated lips, the white variety being rather more abundant than the coloured, and the River Blackwater specimens seemed a trifle more elongated than those from Walton and decidedly less attractive in colour. Unfortunately, my series from these localities are scarcely long enough to be of value for reliable comparisons.

Last summer I collected *Nucella lapillus* in one or two parts of Scotland, namely, the Firth of Forth (under the Forth Bridge), Loch Melfort, Poolewe (Ross and Crom.), and Durness (Sutherland). A comparison between the specimens collected at these places and the southern forms is interesting.

The Forth Bridge shells do not vary greatly, in fact are just as unattractive as the ones from the River Blackwater in Essex, dull in colour and solid in texture, with strongly tuberculated outer lip ; strangely enough I found the red variety of *Littorina littorea* living on the identical stone occupied by one of the *Nucella*.

The Loch Melfort shells are very different. They are slender, with tapering spires, the mouth small in proportion to the height, and the sculpture slight except towards the spire. No coloured specimens were found, all being a uniform white, the inside of the mouth only being coloured a reddish brown, with slightly tuberculated lips.

The Poolewe shells are similar, with a lighter tint inside the mouth and thinner lips ; not many full-grown specimens were found. The species was fairly abundant in both these places.

Going still further north to Durness, a wild spot 58 miles from Lairg and two or three miles from Cape Wrath, there is a marked change. The species swarms on the rocks left uncovered by the tide ; some of the rocks must be at least ten feet high and are quite submerged at high water. The shells conform to the general rule, that those found in exposed situations are stunted in growth, with a mouth large in proportion to the height, but they vary in one particular—the outer lips, in apparently full-grown specimens, are quite thin compared with specimens from similar localities. I have some from Caldy Island, which are much the same size,

but the lips are thick and have strong tuberculations as in the specimen figured by Cooke.¹ None of the Durness shells measure more than 26 mm. in length, most are considerably under. The colours vary from greyish white, through grey and grey with brown bands, to deep chocolate brown, almost black, and vice-versa, giving the shell a very distinctive appearance. The sculpture in most cases is light, with scarcely any signs of foliation, except when very young. The egg capsules, of which I obtained a small cluster attached to a living specimen, were, when fresh, of a beautiful mauve, particularly noticeable in the bright afternoon sunlight.

Quantities of mussels, which abound on the same rocks, were also stunted to about the same proportion as *Nucella*.

Strongly banded and patterned *Littorina tenebrosa* Mont. were found living with the *Nucella lapillus*.

The colouring of shells still remains a mystery. Food must, I think, play a large part in the production of pigment, the colour variation in widely separated localities pointing to this. The colours do not vary in the southern parts of the British Isles to any great extent, as far as I have been able to ascertain, and it is doubtful whether the food supply would vary a great deal, but several hundred miles away one would expect the food to be different, and the shells certainly are.

Until the exact composition of and method of manufacture of pigment by molluscs can be worked out, it is impossible to say if the cause of variation is due to (1) a varying supply of colour elements in the food or water, or (2) the varying ability of the pigment manufacturing organs of the individual to extract these colour elements.

The variation often found in individuals—the colour being unevenly distributed, appearing gradually or suddenly, disappearing altogether or being entirely absent—might be due to inability on the part of the animal. Whether such conditions would be inherited or not is a matter for experiment.

Cooke² is inclined to look upon the black and white banding of *N. lapillus* at Newquay as having a tendency to protective colouration, the bands harmonizing singularly with the veined and banded rocks. I would suggest that this is coincidence; if not, surely the Folkestone shells would adopt a less prominent hue, as they are singularly noticeable on the grey toned rocks, and at Deal, on the upper deck of the Pier, the *Nucella* can be distinctly seen crawling on the lower supports, even when they are beneath the surface of the water.

¹ *Camb. Nat. Hist.*, Moll., fig. 35.

² *Camb. Nat. Hist.*, Moll., p. 70.

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CONTENTS.

	PAGE
The Littoral Zone (Presidential Address)—A. P. GARDINER	65
The Rev. Dr. A. H. Cooke—J. R. LE B. TOMLIN	77
Dr. R. F. Scharff—Id.	79
<i>Planorbis corneus</i> in Co. Down—R. J. WELCH	81
<i>Macra stultorum</i> L. in association with <i>Pinnotheres pisum</i> Penn.—J. G. DALGLIESH	81
<i>Vallonia costata</i> monstr. from East Lothian (with figures)— D. K. KEVAN	82
Preference of <i>Patina pellucida</i> L. for <i>Laminaria digitata</i> — Miss N. FISHER	83
<i>Rumina decollata</i> L. in the New World—E. P. CHEATUM	84
The Fauna of Birdlip Woods—Rev. L. W. GRENSTED	85
Slug and Beetle—C. H. MOORE	85
Non-Marine Shell-Deposits in Yorks and Durham—A. S. KENNARD and B. R. LUCAS	86
A New <i>Hyridella</i> from Australia (Plate 2)—W. J. CLENCH	89
A New Holocene Deposit in Co. Down—R. MACDONALD	91
Editorial Notes	92
Proceedings: 10th Feb., 10th March, 7th April, 12th May, 8th Sept.	94

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THE BRITISH MARINE MOLLUSCA

By R. WINCKWORTH, M.A.

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THE LITTORAL ZONE.

By A. P. GARDINER, B.Sc.

(Presidential Address delivered at the Annual Meeting, 13th October, 1934.)

THE Littoral Zone, which is the area between high- and low-water marks of the spring tides, is a region second to none in interest to the zoologist. There is little doubt but that it was the site of the origin of life, and it presents to the naturalist countless examples of the wonderful adaptations which enable animals and plants not only to exist, but to thrive under conditions of continual change and stress of circumstances. The region is one of the most thickly populated, and the inhabitants are of many different forms and habits. A study of the molluscs alone of this zone presents to us a great number of examples of the probable steps by which animals in past ages have migrated from the sea to fresh water and to the land, and there are numerous cases of species which are still effecting this change at the present time. The keen struggle for existence, which is of necessity found in such a thickly populated area, has resulted in many cases of epizoic and epiphytic conditions and also of such devices for securing food and foothold as symbiosis, commensalism and parasitism.

It is my hope to deal with a few of such points of interest as these in certain coastal areas which seem to me to be favourable to the purpose. Nearly every type of the littoral zone, except the coral reef and the mangrove swamp, occurs in the British area, and the modifications of these types are innumerable. The chief factor which has caused this variation is the position of our islands in relation to the tidal wave. As this sweeps in its course with a velocity of as much as 500 to 600 miles an hour it impinges on the west coast and is split up and diverted in many directions. Some results of this are seen in the characters of the west coast of Scotland, the coast of Lancashire and Cardigan Bay, the Bristol Channel and the coast of Hampshire and Dorset. In the Scottish area the

direction of the tidal wave is more or less at right angles to the coast-line, with the result that deep inlets exist free from extensive deposits of silt and sand. The hardness of the rock in this region probably helps to maintain this condition. In West Wales and Lancashire, on the other hand, the course of the tidal progress is largely parallel with the coast-line, with the result that any inlet is likely to be filled up with sand and the inshore waters thus become shallow, resulting in vast areas being exposed at low tide. The funnel-shaped Bristol Channel is placed at such an angle as to receive the full force of the tidal wave, which becomes piled up as it passes into this great inlet. The result of this is that at Chepstow the difference of water-level is as much as 60 feet. The mean range for this Channel is 42 feet for spring and 21 feet for neap tides. St. Malo and the Channel Islands have, roughly speaking, 40 feet and 20 feet. On the Hampshire coast there are four tides in the twenty-four hours, owing to the tide entering each end of the Solent; the rise and fall is small.

The direction of the wind has a great influence on the height of the tide; many a day's collecting has been made or marred in the Salcombe Estuary or in the Helford River by this factor. In illustration of wind influence, it is recorded that in 1905 the height of the tide in Suffolk was increased by 6 ft. 3 in. by a N.N.W. wind.

For purposes of study it is usual to divide the tidal area into zones. Davenport's system of division is as follows:—

- (1) The Submerged Area. Exposed only at low water of spring tides.
- (2) The Lower Beach. Exposed twice daily.
- (3) The Upper Beach. Only reached by extreme high tides.

The brown algæ afford what is probably the best method of marking out the zones. At the highest point of the upper beach is found *Lichina*. At a slightly lower level *Pelvetia canaliculata* occurs, and near this we find *Fucus platycarpus* and, where fresh-water is present, *Fucus ceranioides*. We then reach the very extensive and conspicuous area of *Fucus vesiculosus*. This is followed by *Ascophyllum nodosum*, never without the parasitic *Polysiphonia fastigata*. With this is *Fucus serratus* followed by *Himanthalia lorea*, with its disc-shaped organs of attachment, and, finally, in the submerged zone *Laminaria saccharina* and *L. digitata*.

This algal mode of division only holds where rocks and stones are present, and it is impossible to draw hard and fast lines. For example, on sand and mud the characteristic vegetation in sheltered positions of the submerged zone consists of the Angiosperm *Zostera*.

In general, the factor which above all determines the flora and fauna of a given region is the perpendicular height, depending on the angle of the coast with the horizontal. Horizontal distance makes no difference. For example, at Oban, in places the tide only recedes a few yards, while at the Seymour and Icho Towers, in Jersey, it is necessary to go out as much as 2 or 3 miles to reach the extremity of the low water fauna.

Other important factors of determination are the changes of density and temperature and, especially in rock pools, the concentration of the hydrogen ion. Moore, in 1915, attributed the observed increase of alkalinity of sea water to the increase of the phytoplankton; a similar change has been observed in rock pools at different places when *Ulva* and *Enteromorpha* have made rapid growth.

After these few general remarks on the subject of my address I will try to illustrate some of the points which seem to me to be of the greatest interest by reference to collecting and observation conducted for many years at the following places :—

- (1) Salcombe Estuary with some points of comparison with the Helford River.
- (2) Oban.
- (3) Places on the west, south, and south-east of Jersey.
- (4) Pendine, Pembrokeshire.
- (5) The bay between the Castle and Penance Points, Falmouth.

SALCOMBE ESTUARY.

This is probably as nearly an ideal collecting ground as it is possible to find; it affords good examples of Davenport's three zones.

The *Submerged Zone* is extensive, and in the sand and mud areas is covered with *Zostera*. Near the mouth, however, the ground becomes hard in places with rock and stone and, finally, when the bar, immortalized by Tennyson, is reached, we find clean sand with little life except a curious form of *Spisula solida*, which has generally to be obtained by the use of the dredge.

Davenport's *Lower Beach* is also represented in several different forms. Near the Marine Hotel it consists of sand and mud and, alas! empty bottles and tins. Further down the estuary it is composed of rocks and pools rich in life.

The *Upper Beach*, too, is typical, and presents most of the forms usually found in this position. The particular zone is dealt with elsewhere.

We will consider first the *Zostera* as exposed at a good tide, and

it must be a good one. Vigorous work with a strong garden fork, even at a moderate state of the tide, will expose two fine worms of the Polychæta—*Amphitrite edwardsi* Quatrefages, and lower down in the zone *Amphitrite johnstoni* Malmgren. The latter occurs also on a bank, the Salstone far up the Kingsbridge branch of the estuary where, however, the former is scarce or absent. Both are found near the Marine Hotel. Associated with them is a very large handsome member of the Aphroditidæ, *Lepidasthenia argus* Hodgson, and frequently a smaller member of the same family of worms, *Lepidonotus clava* (Montagu). The flat form of both of these worms prevents them from getting in the way of their fat and rotund companions. With these two associations of worms we shall find the small bivalve, *Mysella bidentata* (Montagu). These filter feeding bivalves must derive benefit from the débris and minute organisms occurring in the burrows of the worms and they also enjoy a sheltered habitat, especially valuable to them in their early stages. *Mysella bidentata* does not always depend on this kind of shelter, as witness its occurrence in crevices of rocks; I have noticed this particularly in the summer months, far more than in the springtime, at Marazion and at Falmouth.

Other small bivalves such as *Cardium exigum* Gmelin, *Thyasira flexuosa* (Montagu), and, more rarely, the minute *Lepton* (*Epilepton*) *clarkii* Clark, occur near these Polychæte worms and also near the common lug-worm, *Arenicola marina* L., and the rather rarer *Arenicola ecaudata*, Johnston. I do not think that these species have any particular commensal relation to the worms.

If we examine some of the harder parts of the shore we shall see definite holes; on thrusting down the fork and lifting the ground quickly, burrows with a yellowish lining of as much as an inch in diameter will be seen. If we are fortunate and quick, and if the water does not fill the holes too quickly, we shall capture the two Crustaceans, *Upogebia deltaura* Leach and *Upogebia stellata* (Montagu). Of these two the former is the larger. With still greater good fortune we shall see on the yellow lining of the burrows the beautiful flat white bivalve, *Lepton squamosum* (Montagu). Specimens of these which were found by Winckworth and Salisbury spatting while in captivity. In this case also, a flat organism, the *Lepton*, allows its commensal to pass it with ease in the burrow. The *Lepton* leads a sheltered life and feeds upon débris and minute organisms in the burrow.

The most exciting find is yet to be made. Far down the zone the fork will expose the worm-like Echinoderm, *Leptosynapta inhærens* (Müller). Firmly attached to this we may find one, perhaps more, examples of the bivalve *Entovalva* (*Devonia*) *perrieri* (Malard). These

are generally attached near the posterior end of the Echinoderm. Until this species was rediscovered by Orton, and further found in quantity by Winckworth, it was one of our rarest shells. This case, and that of *Lepton squamosum*, are good examples of the comparative ease with which some animals are found when looked for in the right places, but never elsewhere. Our classic textbooks on conchology are frequently deficient in matters of this kind, and there is much work to be done by us all.

If we cross the ferry we find two other very interesting associations. In some of the most glutinous areas the fork will turn up a squirming mass of arms. This consists of the Echinoderm *Ophiocnida* (*Acrocnida*) *brachialis* (Montagu), and with it will be found two commensals, *Mysella bidentata* (Montagu) and the flat Chætopod worm *Harmothoe lunulata* (Delle Chiaje).

In a bay of clean sand a little way down the estuary slit-like holes will betray the Echinoderm, *Echinocardium cordatum* (Pennant). With this occurs another bivalve, *Montacuta* (*Tellimya*) *ferruginosa* (Montagu), but this association is not a very close one, the bivalve being generally found free from the Echinoderm. The colour of the former matches the sand so well that it is easily overlooked. Many specimens of this shell in the older collections were taken from the stomachs of fish at Cruden. I have dredged it without *Echinocardium* in 5 fathoms off Teignmouth.

A worm, *Polydora ciliata* (Johnston), bores into both living and dead shells. The sponge, *Cliona celata* Grant, has the same habit. The sponge may be obtained by dissolving the shell with dilute hydrochloric acid.

Associations of probably a purely epizoic character are seen in the angled white tubes of the worm *Pomatoceros triqueter* (L.). *Serpula vermicularis* L. makes a rounded tube in the same position. Another tube-building worm, *Filograna implexa* (Berkeley), makes a mass of much smaller tubes. Shells and algæ are frequently covered by the tubes of the worm *Spirorbis borealis* Daudin; these resemble small Gastropod shells.

The worm *Sabellaria alveolata* (L.) constructs dense masses of tangled tubes, often many yards in extent; these reef-like structures afford shelter to countless species of mollusca, worms, crustacea, etc., and are a rich hunting ground.

Competition for space and desire for protection result in even the dead shells of Gastropods being turned to account by Crustaceans and Cœlenterates in wonderful commensal and symbiotic associations. *Eupagurus prideauxi* (Leach) often has the anemone *Adamsia palliata* (Bohadsch) on its shell. *Eupagurus bernhardus* (L.) generally has *Calliactis parasitica* (Couch) as its companion. The

Hydroid, *Hydractinia echinata* (Fleming) also frequently covers the shells inhabited by crabs. These family parties are often completed by a worm, *Nereilepas* (*Nereis*) *furcata* Savigny. These are cases of true symbiosis, the benefit of the association being mutual. The active crab moves the anemone from place to place, the latter feeds on the débris of the crab's captures and, in return, protects the crab from prowling fish by means of its stinging organs. Another hermit crab, *Eupagurus cuanensis* (Thompson), uses a sponge, *Suberites domuncula*, and not a shell for its home.

Another interesting case of the use of dead shells is that of the worm *Phascolion strombi* (Montagu); this blocks up the mouth of the shell with a cement substance in much the same way as a bird, the nut-hatch, diminishes the size of a hole in a tree with mud to adapt it to nesting purposes. I have found the shells of *Turritella*, *Aporrhais*, and *Dentalium* to be those most frequently used. In the Cambridge University Museum there is a series of such shells with the worms in situ. On the coast of Brittany this worm is found associated with a Gastropod, *Odostomia perezii* Dautzenberg and Fischer, and a bivalve, *Montacuta* (*Tellimya*) *perezii* D. & F. I am indebted to Mr. R. Winckworth for information on this matter; he thinks that the occurrence of the bivalve in British waters is so probable that he has included it in his 1932 list under the name of *Montacuta phascolionis* D. & F., marked "Q". Every blocked shell should be examined with great care. I have dredged these on the Cornish coast and at Oban.

Musculus marmoratus (Forbes) occurs just below the tide limit, living in Ascidians. Near the Salstone *Lamellaria perspicua* (L.) is found under the test of the Ascidian, *Leptoclinum maculosum* Edw. This seems to be a case of the bivalve seeking shelter for breeding purposes. Miss K. White found this association on several occasions in the Isle of Man.

In the *Zostera* beds of Helford, but not in those of Salcombe, I have observed the association of *Bittium reticulatum* (da Costa) with a sponge. Of course, the occurrence of *Cerithiopsis barleei* Jeffreys with *Ficulina ficum* has been known for a long time.

Before leaving Salcombe the largest British bivalve, *Pinna fragilis* Pennant, should be sought for by looking along the surface of pools, where the broad end of the shell may be seen just projecting above the surface of the sand or mud. This animal has been found by treading on it with the bare foot, but this is not a pleasant way of detecting it.

Salcombe has not produced *Pelseneeria* (*Stilifer*) *styliifera* (Turton) with its Echinoderm host, but the Pea Crab, *Pinnotheres pisum* (Pennant) occurs with *Modiolus*. This seems to show definite

selection in the behaviour of the crab, for Orton found that fat and well-nourished mussels were selected. The female appears to sit upon the ctenidia and scrapes up the mucus laden with food particles. She is visited there, while inside the mussel shell, by the male, who sometimes comes to an untimely end by being trapped between the valves of the shell.

A reasonable explanation of how such associations as those of worms, Echinoderms, and Crustacea with bivalves may have arisen, seems to be that any spat of these prolific molluscs which happens to remain in, or enters, burrows, has a better chance of reaching maturity than has spat not thus protected. This seems to be one way of accounting for the fact that *Lepton* and *Devonia* are found in the company of the animals with which they live. Further, it is easy to imagine that the actual parasitic habit of animals like *Devonia* may have arisen through propinquity brought about at first by chance. The ingesting of mollusca by sponges and Ascidians may have arisen in a similar way.

The leaves of the *Zostera*, as well as the soil in which it grows, have a characteristic fauna. At Salcombe and at Helford the dominant species are *Cantharidus striatus parvus* (da Costa), *Rissoa membranacea* (J. Adams), and *Haliclystus*. *Buccinum* and *Littorina* are frequent on the substratum, while at Helford, but not in similar situations at Salcombe, *Haminoea navicula* (da Costa) may be found by thrusting the hands down into the mud around the roots of the *Zostera*.

Instead of mentioning any other species found at Salcombe, I will record a fact that has come to my notice in connection with the occurrence of different species in different years. In April, 1930, *Tethys punctata* (Cuvier) swarmed in hundreds between the Marine Hotel and the Castle, but there was not one on the opposite side of the estuary. *Archidoris britannica* (Johnston) and *Aeolidia papillosa* (Linné) were also very plentiful. There were very few *Pleurobranchus membranaceus* (Montagu). In the following year *Archidoris* and *Aeolidia* were as numerous as ever, *Pleurobranchus* was scarce and *Tethys* absent. In April, 1933, *Pleurobranchus* simply swarmed everywhere, in the dredges, on the Salstone, and near the Hotels. On the other hand, only one *Aeolidia* and two or three *Archidoris* were seen. These were the results of the hunting of my pupils, not only of my own efforts. There was little in the differences of climatic conditions to account for these facts, and the observations were made during spring tides of about the same date. A very extensive inshore migration of these species, lasting for a very short time, seems to be indicated. Full records, taken over a long period of time, would be of great interest.

JERSEY.

The chief collecting grounds are at the south and south-east, near the Seymour and the Icho Towers, and at the west end of the island at la Pulente and l'Etac.

The most notable characteristics of our area here are the swift tides and the flat shores. The result is that the tides recede for a vast distance and ebb and flow with great rapidity. Marshall states that the ebb takes seven, and the flow five, hours. Particularly is this the case at the two Towers. The Icho Tower is, if anything, the more dangerous of the two because the wild jumble of rocks between it and the mainland is intersected by deep and wide channels running parallel with the latter. Through these the rising tide rushes with great velocity, and woe to the person who too long delays his return to the shore.

Much of the best collecting is 3 miles or more from the land. Marshall, in his *Additions to British Conchology*, refers to the occurrence of *Macra glauca* Born. It is found in grit to the north-east of the Seymour Tower, and is accompanied by *Donax variegatus* (Gmelin) of several varietal forms. Here also occur *Gari fervensis* (Gmelin), *Gari depressa* (Pennant), *Pharus legumen major* Bucquoy, Dautzenberg & Dollfus, *Solen marginatus* Montagu, *Ensis ensis* and *siliqua* (Linné), *Lutraria magna* (da Costa), and many other bivalves; an extensive and typical association for this kind of substratum. There are pools near the Tower with big stones under which large *Octopus vulgaris* Lamarck lurk. Marshall refers to the danger of collecting in this place in saying, "the stranger is at first appalled at the apparent disappearance of the island and at the utter chaos of the rocks which surround him." On one occasion I could only find my way back from the Seymour Tower by compass, owing to a sea fog that prevented my seeing more than a few yards around me.

One interesting association which occurs near the Towers, at Green Island, St. Brelade's Bay, la Pulente, and l'Etac is that of *Lepidopleurus cancellatus* (Sowerby), *L. scabridus* (Jeffreys), *Tornus subcarinatus* (Montagu), *Alvania lactea* (Michaud), and *Alvania carinata* (da Costa); these occur under stones rather deeply embedded in the mud and sand. With them occurs a Crustacean, *Axius stirhynchus* Leach, whose burrows are gutters of which the embedded stone forms the roof. This seems to be an association similar to that of *Upogebia* and *Lepton squamosum*. If this is the case, the difficulty of accounting for the supply of food of these species of mollusca is removed. A third association typical of this place is that of *Halotis tuberculata* Linné, *Acanthochitona communis* (Risso), and *Ocenebra aciculata* (Lamarck). These are found under large

stones resting on others at an angle in pools. It is in the occurrence of the first and last of these, and of *Alvania lactea* (Michaud), and of the great numbers of *Acanthochitona communis* (Risso) that the molluscan fauna of this place differs from that of similar situations in Great Britain. The three above-named species of the Loricata seem to take the place, to a great extent, of *Lepidochitona cinereus* (Linné), *Acanthochitona crinitus* (Pennant), and the more local *A. discrepans* (Brown), *Tonicella marmorea* (Fabricius), and *T. rubra* (Linné) and *Callochiton achatinus* (Brown), of the British coasts. It is difficult to explain why a species occurring in both regions should be very common in one and rare in the other, when there is no satisfactory explanation to be got from the environment. This is a point that arises in other parts of this paper and I have ventured to call such species "equivalent".

One other point is the rarity of *Galeomma turtoni* Sowerby in Jersey, although it is fairly common in other islands of the group. I found two under the same stone at l'Etac, at the end of a long day. The next day the turning over and turning back of hundreds of stones at the same place did not yield one.

Mr. Pike, of the Jersey Museum, showed me specimens of *Onchidella celtica* (Forbes & Hanley) from l'Etac. These occurred, like mine at Trevone, at a much lower zone than has been attributed to them. I have never found specimens at or near the high-water mark, much less above it, as has been stated by many writers.

OBAN.

Mr. Winckworth, who directed me to the best hunting ground in Kerrera Sound, told me that I should go home "tired, bleeding, but successful", and I did! Never have I come across such sharp stones perched at such precarious angles. The shore is so steep that the tide only recedes a few yards and care is necessary to avoid being thrown into deep water when turning a stone.

The "equivalent" species of chitons are *Tonicella marmorea* (Fabricius), *T. rubra* (Linné), *Callochiton achatinus* (Brown), and *Lepidopleurus asellus* (Gmelin). These are dominant and seem to replace those found in the south.

The Laminaria is remarkable for the grand Pecten *Chlamys nivea* (Macgillivray) and for the beautiful *Margarites helycinus* (Fabricius). The latter seems to be equivalent to *Lacuna parva* (da Costa) in the south. *Chlamys distorta* (da Costa) was very fine. The largest *Lacuna crassior* (Montagu) that I have ever seen occurred here. I swallowed the largest one when turning over a rock; however, regurgitation took place, so that, unlike the fisherman's largest fish, it was not lost.

Other invertebrates found here were *Terebratulina caput-serpentis* (Linné), *Crania anomala* (Müller), *Munida rondeletii*, *Galathea strigosa* (Fabricius), and *Pycnogonium littorale*. The *Fucus* was thickly covered with *Clava squamata* (Müller); only at the Salstone have I seen so much of it.

It was noticed that the *Lepidopleurus asellus* (Gmelin) in the Laminarian zone were much larger than those dredged. The largest of the former measured 1.9×1.3 cm., while the latter were only 0.8×0.5 cm.

Trophon truncatus (Ström) is very common and seems to be the equivalent species to *Philbertia purpurea* (Montagu) on a beach such as that of Marazion or of Falmouth.

Patelloida tessulata (Müller) largely replaces *Patella vulgata* Linné.

Cantharidus clelandi (Wood) and *Trichotropis borealis* Broderip and Sowerby occurred in numbers just below the tide-mark, and *Lima sulcata* Brown in deeper water off the Maiden Rock. Perhaps the comparative scarcity of *Nucella lapillus* (Linné), *Patella*, and *Mytilus edulis* Linné accounts for the extraordinary richness of the fauna in other respects.

The greatest find of all was *Emarginula crassa anassa* Dean. On our first day almost the first upturned stone yielded two large ones, but the total number of adults found in two weeks in two separate years was small. Of these, one found by Miss White probably holds the record for size in British waters. There were very many small ones occurring with *Emarginula conica* Lamarck. This species seemed "equivalent" to *Emarginula reticulata mulleri* Forbes & Hanley of the south.

Trivia monacha arctica (Montagu) is very large and entirely takes the place of *Trivia monacha monacha* (da Costa).

FALMOUTH.

Time prevents me from saying much about this locality, so famous as the chief hunting ground of Cocks.

Excellent examples of the Upper Beach are presented. Here one finds *Littorina neritoides petraea* (Montagu) well on its way to become a land form. With it live dwarf *Littorina saxatilis* (Olivi), *Mytilus edulis* Linné, and the bivalve *Lasæa rubra* (Montagu). These hide in the *Lychina*. *Otina ovata* (Brown) may be on its way to the land from its damp caves, but I have always found it much farther down the zone than would be expected for a Pulmonate. Near the Lizard it occurs at about half-tide. In connection with the question of migration to the land Tattersal states that *Littorina neritoides* (Linné) has lost its metamorphosis, having no free veliger stage. The same is true of *Littorina saxatilis* (Olivi), so that

these two species, accustomed to long exposure to the air, are far advanced in the landward migration.

Littorina littoralis (Linné), of a lower zone, has a somewhat abridged metamorphosis, while the still more maritime *Littorina littorea* (Linné) has retained its full typical series of larval changes. At first sight it seems that the most natural and easy method by which transition from sea to land could take place would be through the intermediate brackish and freshwater existences. This, no doubt, is sometimes the case. An obvious example is seen in the estuarine and brackish species, *Hydrobia jenkinsi* Smith. This now swarms in thousands in the River Pang at Bradfield, and I have frequently found it alive in a damp coppice. Here, probably, it has been deposited by flood water and survived for a time. In this method of migration the osmotic difficulty has to be overcome. In this physical process water tends to pass through a membrane from a more dilute into a more concentrated solution until equilibrium is established. This flow is most deadly in its results, for example, brittle starfish are killed so suddenly by immersion in freshwater that even they have not got time to perform autotomy. Exquisite specimens may be obtained in this way without the risk of loss of arms.

In favour of the theory of direct migration from sea to land direct, rather than through an intermediate freshwater phase, it is known that the Upper Beach *Lasæa rubra* can live exposed to air for nine days, but not for one in freshwater. The numbers for some other species are :—

<i>Littorina neritoides</i> .	Air 42 days.	Freshwater 11.
<i>L. saxatilis</i> .	„ 31 „	„ 7.
<i>L. littorea</i>	„ 23 „	„ 7.
<i>L. littoralis</i> .	„ 6 „	„ 2.

These results are those of Colgan (1910).

As a rule the lower its zone on the shore the less power an animal has of resisting freshwater. These considerations seem to point to the possibility of *Pomatias elegans*, for instance, having undergone direct transition. Cooke, in 1895, observed landward migration of three species of *Littorina* at Panama. These were actually on trees.

The Falmouth section of coast, including as it does rocky coves, sandy beaches, and reefs of rocks with splendid pools, is an excellent place for observing examples of protective resemblance. Space only permits me to mention *Rostanga rufescens* Iredale and O'Donoghue. Here I have frequently found this red nudibranch under stones, but never on red sponge; thus this would seem to be a case of warning rather than of protective colouration.

In the rock pools *Patelloida virginea* (Müller), *Patella depressa* Pennant, *Patella athletica* Bean, are very inconspicuous on the calcareous algæ *Melobesia*, *Lithothamnion*, and *Corallina*. *Littorina littoralis* frequently, but by no means always, matches the *Fucus* on which it lives. Cases of protective resemblance in the Nudibranchs are very numerous.

I have often wondered if the blue lines of *Patina pellucida* (Linné) may not help to break up the outline of the animal in the same way that the bright stripes of the larvæ of Hawk-moths help to render the creature inconspicuous.

Arca tetragona britannica Reeve, *Arca lactea* Linné, *Ocenebra erinacea* (Linné) on this coast and *O. aciculata* (Lamarck) and *Haliotis* in Jersey are good imitations of lumps of stone.

These Cornish beaches are not what they were thirty years ago, when I worked them year in and year out for six years. During the War an oil tank ship went on the rocks and was burnt there. For some years the flora and fauna were wiped out. In 1931 life was nearly but not quite normal near the site of the disaster. Gillan Creek, towards the mouth of the Helford River, might at one time have served as the happy hunting ground of good biologists—its fauna was ruined in one night by a drift of oil from a wreck on the Eddystone. We were at Gillan the day before and the day after. This occurred some years ago and perfect recovery has never been made. How many millions of crabs and lobsters in the adult and larval state must have been killed, to say nothing of other animals of importance as fish food!

Finally, one word about the last type of shore: Our example is Pendine and Amroth in Pembrokeshire. On this sandy wave-swept expanse the molluscs must either burrow in the sand and have long tubes, or be prepared to roll like *Actæon tornatilis* (Linné), the most characteristic animal of this region; it can often be found in the wet sand by following its tracks. *Tellina squalida* Montagu, *Diplodonta rotundata* (Montagu), and *Mysia undata* (Pennant) amongst the scarcer species, with *Cyprina islandica* (Linné), large white *Venus striatula* (da Costa), *Donax*, *Lutraria*, *Spisula*, *Mya*, *Pharus*, *Cultellus*, *Ensis*, *Solen*, and *Macra* form banks of dead shells.

In the submarine forest at Amroth *Pholas* and *Barnea* of great size occur in the subfossil wood. Pendine is also famous for *Clathrus turtonis* (Turton). A pupil of mine whom I sent there found three in one day. Here there are no stones to leave unturned and none to leave the wrong way up.

The Rev. Dr. A. H. COOKE.

By J. R. LE B. TOMLIN.

ALFRED HANDS COOKE was the son of Edward Cooke, of Enfield, and born on 5th October, 1854. He was a collegier at Eton, eventually captain of the school, and one of the school Field XI. In 1874 he won the Newcastle, and becoming a member of King's College, Cambridge, he proceeded to carry off almost every distinction open to classical scholars, as well as captaining the College Association XI from 1874-8.

In the latter year he was Senior Classic and 1st Chancellor's medallist. Elected to a Fellowship of his College, and ordained by Wordsworth, Bishop of Lincoln, he spent more than twenty years successively as Lecturer, Dean, and Tutor, and served for more than ten years as Assistant Censor of non-collegiate students in the University. He was also for many years Lecturer and Honorary Chaplain at Girton College.

In 1900 he accepted the headmastership of Aldenham School and remained there for twenty years. In 1920 Eton offered him the living of Mapledurham, on the Thames, and he died at his vicarage on 28th November last at the age of 80, only three weeks after the death of his wife.

He married Miss Mary Louisa Seels, of The Hall, Wainfleet, in 1881, and had two sons; the younger, Alan, also a King's man, was reported missing in the War and never heard of again; the elder, Cyril, of Marlborough and King's, won the M.C. in the War and became headmaster of Dunchurch Hall School, near Rugby.

But Cooke, great classical scholar as he was, had another claim to distinction; he was no mean scientist and his volume on *Molluscs* in the Cambridge Natural History series (1895) is still a standard book of reference.

The first conchological paper that he wrote was on the shells of Guernsey, Sark, and Herm, in conjunction with H. M. Gwatkin, of St. John's College (*Journ. of Conch.*, Vol. I, p. 321), and this collecting in home waters inspired him to go much further afield.

He spent part of a Long Vac. at Panama, when it was still an unspoilt locality—inspired thereto by the accounts of C. B. Adams's foray many years before and the richness of his spoils—and himself brought back a very fine collection. He was never tired of describing the incidents of this trip, the numerical abundance of so many of the species, the exhausting effect of collecting in the tropical heat; the climax was reached when he staggered home one day with a sack over his shoulder containing nearly a dozen live specimens of the big *Strombus galeatus* Swainson.

The association of Cooke and Gwatkin mentioned above became ever more intimate and the ties of friendship were knit closer by the interest in a common hobby. Gwatkin, of course, had very early taken up the study of radulæ and devoted himself wholeheartedly to their acquisition and mounting. Cooke was induced to supplement Gwatkin's work by photography, and as the latter's fame spread he was constantly appealed to by foreign malacologists for information about radular characters, which was most conveniently imparted in the form of a photograph.

Cooke's favourite groups in the Mollusca were *Thais* (*Purpura*) and *Clausilia*. The former taste was the result of his trip to Panama, where species of *Thais* were numerous and particularly attractive. The latter was gradually engendered by his travels in Europe and Palestine, especially in the mountain haunts of the *Alopiæ* group. He amassed an extraordinarily complete series of the common *Nucella lapillus* (L.), illustrating its variation along the whole line of its known range; this series, as well as his enormous accumulation of Clausiliidæ, was presented to the British Museum (Natural History) a year or two ago.

He was President of the Malacological Society from 1913 to 1915 and of the Conchological Society 1919-1920. While at Mapledurham he made an intensive study of the history of the parish, which eventually appeared in book form.

Recollections of him at Cambridge in the early eighties bring to mind a tall, spare, fair man, with a slight limp (due to a football accident), short-sighted, distinctly chilly and academic in manner to a stranger, but to friends he revealed a vigour, a breadth of mind and an enthusiasm which were alike inspiring and infectious. He was Curator in Zoology of the University Museum from 1880 to 1890, under John Willis Clark, and a constant association with him there for four years taught one more in many ways than can be easily acknowledged.

The Times, reviewing his career at Aldenham, says of him: "Patient and painstaking, courteous and considerate as he was, there was yet in him a hint of power in reserve—a standard set and maintained in himself and anticipated in others." This, I think, sums up Cooke's character well; he was the embodiment of *noblesse oblige*, and such a character is a tremendous asset whether at the 'Varsity, at a public school, or in a country parish.

Dr. R. F. SCHARFF.

By J. R. LE B. TOMLIN.

ROBERT FRANCIS SCHARFF was born in Leeds in 1858. He studied at three universities—Edinburgh, University College, London, and Heidelberg, and took the degrees of M.A., B.Sc., and Ph.D.

Zoology was always his chief subject, and after spending some time at the Marine Biological Stations of St. Andrews and Naples he accepted, in 1887, a post in the Dublin Museum of Science and Art—now the National Museum—as Assistant in Natural History under A. G. More, a joint author of the *Cybele Hibernica*. Three years later, on More's resignation, Scharff was appointed Keeper, and held this post until 1921. From the beginning of his work in Dublin he was an active member of the Royal Irish Academy and the Royal Zoological Society of Ireland and very frequently an officer of one or the other. He was also for a long time on the Council of the Royal Dublin Society, a Fellow of the Linnean and Zoological Societies of London, and a constant attendant at international zoological meetings on the continent, where his ability as a linguist was an invaluable asset.

In 1895 he was awarded the prize given by Emperor Nicholas II at the International Congress of Zoology. In 1906 and 1908 he delivered the Swiney lectures on Geology in London.

After his retirement he lived on in Ireland until about two years ago, when he moved for a short time to Lausanne. Only two months before his death he had carried out a project of settling on the south coast. He died at Worthing on 11th September.

Scharff was twice married and had two sons and one daughter; his second wife was Miss Jane Stephens, of Dublin, who had been an assistant under him at the Museum and is well known for her work on Sponges.

Scharff was to all intents and purposes an original member of the Conchological Society, as has been proved by Dr. Jackson (*Journ. of Conch.*, Vol. XVIII, p. 66); in 1879 we find him a Vice-President (*Journ. of Conch.*, Vol. II, pp. 315 and 322), and in 1902 he was elected President. His address was entitled "The Origin of the Land and Freshwater Mollusca at present living in the British Isles".

His contributions to this *Journal* were few in number and with the above exception not particularly important, but he left his mark on scientific literature by three books dealing with his favourite subject of the distribution and dispersal of animals. These books were *The History of the European Fauna*, 1899; *European Animals*, 1907; *The Distribution and Origin of Life in America*, 1911.

His interest in the problems of distribution and migration naturally turned his attention to the Irish fauna and in 1893 the Royal Irish Academy appointed a Fauna and Flora Committee with Scharff as Chairman. His position at the Museum enabled him to assist and encourage the study of Irish animals very considerably, and at different times he made important critical contributions on wood-lice, on deep-sea fishes, on non-marine mollusca, and on fossil vertebrates from cave deposits. He also wrote on the origin of the Irish races of domestic animals and on the Irish names of indigenous creatures.

Commenting on Scharff's views, Mr. Lloyd Praeger writes as follows :—

“ In all these studies Scharff found—as many others have done—extreme difficulty in accounting for present faunal distribution and the close relationships existing between the faunas of separated areas in view of the serious barriers offered to migration by intervening areas of sea. Trans-marine migration on the necessary scale under existing geographical conditions, indeed, was to him an impossibility. And in spite of theories of the permanence of ocean-basins and all geological difficulties, he invoked former land-bridges across which the fauna had migrated from island to island and from continent to continent. The biological evidence appeared to him incontrovertible, and geological difficulties were minimized. In claiming that the present distribution of animal and plant life demanded a different distribution of land and sea in times geologically recent in order to allow of terrestrial migration, Scharff was a forerunner of Wegener, but they proposed different solutions of the problem—Scharff raising parts of the ocean beds to form land-bridges, Wegener even more sensationally obliterating the intervening seas by moving the continents together into a single great land mass.

“ A second difficult and controversial problem connected with the history of the present fauna and flora centres round the Pleistocene glacial period. Scharff read and thought much over this ; his conclusion was that much of our animal and plant population must have existed in or near its present habitats throughout this time : from this he inferred that the conception of some thousands of feet of ice over, for instance, our own island must be erroneous. I think that evidence is on the increase that the ice was not simultaneously over the whole of Ireland, and, indeed, that it was not over certain areas at all ; but to Scharff the idea of any widespread ice-cap was untenable : the Ice Age, he believed, was essentially a wet, not a cold period ; and he even attempted to explain glacial striæ as due to stones pressed against

the rocks not by ice but by mud. He was not content to accept such difficulties as incapable of explanation, but boldly put forward the solution which to his mind appeared the most probable.

“He was a conscientious and diligent worker in the zoological field, thorough and painstaking, and had little sympathy with the superficial or hasty work which sometimes passes for scientific research in these later days; but he was always tolerant of the views of others.”

Planorbis corneus (L.) in Co. Down.—I have to record *Planorbis corneus* from Co. Down, though only from a new garden pond, where I saw no sign of it last year. Lately, when in the Marchioness of Londonderry's famous gardens at Mountstewart, Ards Peninsula, Co. Down, the head-gardener took me to a pond in the new Spanish garden, where pond-snails were causing much damage to rare water-lily leaves. I found that two well-known Britannic species were causing the trouble, *Planorbis corneus* (L.) and *Lymnæa stagnalis* (L.), the latter much the more abundant of the two and doing most of the damage. Some leaves were almost entirely eaten away. The pond had been cleaned out, but I was able to get about half a dozen of the *Planorbis* and over a dozen of the *Lymnæa* for the Belfast Museum aquarium tank, as well as leaves almost completely covered with the gelatinous egg masses. It is interesting to find it again in the north of Ireland, far from its Kildare and Queen's County natural habitats, so soon after Miss Fisher's record for Cushendall, Co. Antrim, where it occurs plentifully in a hotel garden pond.—R. J. WELCH.

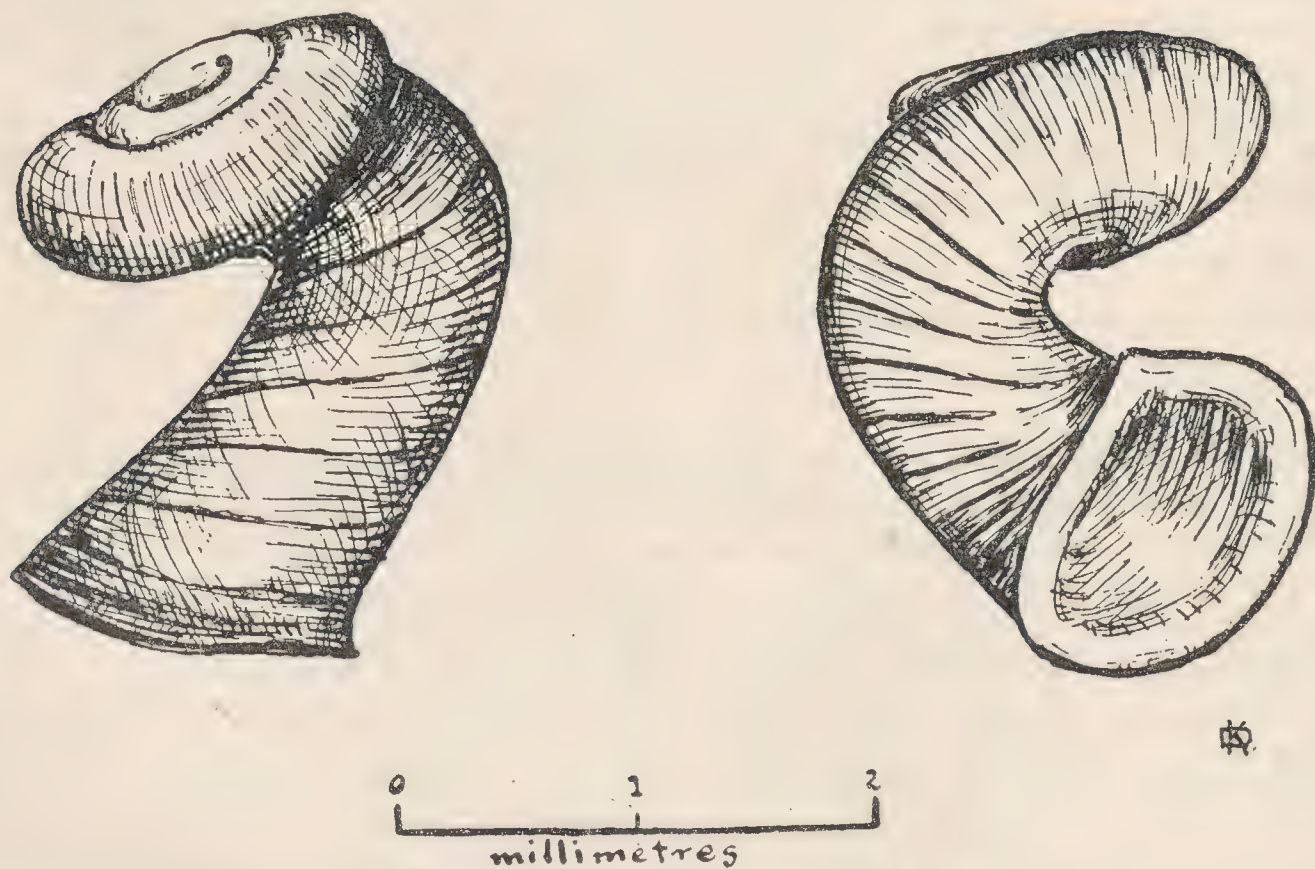
Macra stultorum, Linn. in Association with *Pinnotheres pisum* Penn.—Last August (1933) a specimen of *Macra stultorum* Linn. was found living at low water, Hove, Sussex, in association with *Pinnotheres pisum* Penn. As this host of the latter was considered to be unusual, the occurrence was notified to Dr. Isabel Gordon at the Natural History Museum, South Kensington, who kindly supplied the following information: “I have not found any record of the association of *Pinnotheres pisum* with *Macra stultorum* in European waters, and presume that it must be unusual. An Indian Ocean species, *Pisum matricolus*, was found in *Macra violacea* by the late Colonel Alcock. The molluscan hosts of *P. pisum* for European waters are, in addition to *Mytilus edulis* and *Cardium edule*, *Modiolus vulgaris*, *Cardium exiguum*, *Cardium norvegicum*, and *Glycymeris*. They are also found in association with certain Ascidians.”—J. GORDON DALGLIESH. (Read before the Society, 10th March, 1934.)

VALLONIA COSTATA (MÜLL.) MONSTR., FROM EAST LOTHIAN.

By D. K. KEVAN.

(Read before the Society, 13th January, 1934.)

WHILE collecting on the 5th September, 1933, at the extremity of a long spit of land dividing the shore proper from an extensive salt-marsh in the estuary of the River Tyne, near Tynninghame, East Lothian, I found an extraordinary monstrosity of *Vallonia costata*, which I have attempted to delineate in the attached figures. The specimen was submitted to Mr. A. S. Kennard, who has made a special study of the genus, and he states that he has never seen a *Vallonia* like it before. He adds that while *costata* can be considered the most variable in shape and size of the three British species, it is remarkable how slightly *Valloniae* do really vary, the only definitely abnormal one that he had seen previously being a *pulchella*, extremely high-spined and without a lip, due possibly to some injury to the genitalia. He does not consider that this is the cause in the present case.



Vallonia costata monstr. from shell-sand, estuary of R. Tyne, Tynninghame, near Dunbar, East Lothian.

Apart from various marine (mainly estuarine) and salt-marsh forms (including *Phytia myosotis*) the following land-shells were associated with *Vall. costata* in the shell-sand: *Cepæa nemoralis*, *Helicella caperata* (abundant), *Cochlicopa lubrica*, *Lauria cylindracea*, *Pupilla muscorum*, *Vitrina pellucida*, *Goniodiscus rotundatus*, *Oxychilus cellarius*, and *Punctum pygmæum*. The spit of land is composed

of sand, and is covered by a dense growth of Sea Buckthorn, excepting at the point (north side), a patch a little way down the south (salt-marsh) side, and occasionally along the edges, where Maram grass and other sand-dune plants occur. A few stones are to be found in these open spaces, and, here and there, one or two old tree-trunks or branches, evidently washed up by the tide. Under these I found small living colonies of the following species: *H. caperata*, *C. lubrica*, *L. cylindracea*, *P. muscorum*, *V. pellucida*, *V. costata* and *O. alliarius*, but nowhere was there any sign of living or even recent *C. nemoralis*, although old and broken shells were very common. There seems little doubt that the encroachment of Sea Buckthorn has practically destroyed the area as a snail habitat; some species have already gone, while others are fast disappearing or only just managing to "hang on" in a few isolated situations.

Preference of *Patina pellucida* (L.) for *Laminaria digitata*.—Wherever this common limpet occurs on the coast of North-East Ireland it is almost exclusively found on the fronds of the "smooth" *Laminaria* (*L. digitata*). Praeger¹ says: "Of general occurrence round our shores [the North of Ireland] on the broad fronds of *Laminaria digitata*," and I found this to hold good wherever I collected in North-East Ireland. At Port Ballintrae, Co. Antrim, in October, the fronds of *L. digitata* were literally covered with *Patina*, but it was only after a prolonged search that I found a very few specimens on the "crinkly" *Laminaria* (*L. saccharina*). My experience is thus just the reverse of Gardiner's,² who found that "*Patina pellucida* (L.) prefers *Laminaria saccharina*, and to a less extent *L. digitata* and *Rhodymenia palmata*". His observations were made at "Falmouth, St. Ives, Chideock, Pembroke coast". Sinel³ states that "in the summer months its young [*P. pellucida*] may be seen in numbers on *Laminaria digitata*"—presumably at Jersey, where he worked. Farran⁴ records it as occurring on Fucoids as well as on *Laminaria* (species not stated) at Blacksod Bay, Co. Mayo, and I once (Port Ballintrae) found a single specimen on *Fucus serratus*. Nevertheless, it may safely be said that in North-East Ireland at any rate *Patina pellucida* (L.) shows a decided preference for *Laminaria digitata* over other algæ.—N. FISHER. (Read before the Society, 8th September, 1934.)

¹ Praeger, R. Ll., "The Marine Shells of the North of Ireland," *Rep. and Proc. Belfast Nat. Field Club*, vol. 2, 1887-1888, Appendix iii, p. 81, 1889.

² Gardiner, A. P., *Journ. Conch.*, vol. 18, p. 311, 1929.

³ Sinel, J., *Outline of the Natural History of our Shores*, pp. 203-4, 1906.

⁴ Farran, G. P., *Results of a Biological Survey of Blacksod Bay, Co. Mayo*, pp. 9, 64. Fisheries, Ireland, Sci. Invest., 1914, iii.

RUMINA DECOLLATA LINNÉ IN THE NEW WORLD.

By ELMER P. CHEATUM (Southern Methodist University, Dallas, Texas).

THE exotic snail *Rumina decollata* L. with its characteristic decollated shell appears to be having a rather rapid dissemination in certain parts of the United States. Although indigenous to the Mediterranean region, it has been reported from ten localities in the United States, seven of them being in Texas.

For the past three years, this species has been thriving in several backyards in Oak Cliff, a suburb of Dallas, Texas. Mr. John Litsey, of Dallas, first mentioned its occurrence within the city to the writer, and several subsequent field trips to its present locality have furnished interesting ecological data.

Rumina is active intermittently throughout the winter in Dallas. A rainy period followed by a few warm days results in their appearance at the surface of the ground; a few cold days will cause them to burrow into the soil, sometimes far enough down completely to cover their shells. Recently (5th January, 1934) a trip to the area inhabited by these snails revealed a considerable number burrowed under a dense mat of periwinkle vines (*Vinca*). Some had their shells completely exposed; others were entirely covered by humus or had only the apices of their shells visible.

On a recent trip (1st to 3rd February, 1934) to south central Texas, *R. decollata* was found in abundance along the banks of the Guadalupe River, one-half mile south-west of Greene. Collections were made approximately one-fourth mile up and down the river in this vicinity and shells both living and dead were found equally abundant at all points. In Breckenridge Park, San Antonio, this species is distributed all along the banks of the San Antonio River that meanders through the park.

Pilsbry, in his *Manual of Conchology* (2nd series, vol. 17, p. 212, 1905) summarizes the distribution of this species as follows: "Entire Mediterranean region, the typical forms from southern France, Italy, Sicily, Canary Is. Introduced in the Azores, Madeira, and Cape Verde Is., Bermuda, Santo Domingo, Cuba (Havana), Charleston, South Carolina." Johnson (*Naut.*, xiii, p. 117, 1900) speaks of a colony that lived for a while in Philadelphia, one individual being found devouring a specimen of *Helicella ericetorum*. Smith (*Naut.*, xx, pp. 4-6, 1912) notes the shells as common in cemeteries of New Orleans, La., and the older parts of Mobile, Ala. Ferriss (*Naut.*, xxviii, p. 11, 1914) calls attention to its being found by Camp in Brownsville, Texas. Recently *Rumina* has been collected in the south part of Houston, Texas, by Mr. Robert

Tenery. The writer has before him shells from Houston, Greene, and Dallas. Shells from Greene and Dallas are much lighter in colour than those from Houston. It seems quite probable that this species occurs over a much wider area in the southern United States than hitherto reported.

The Fauna of Birdlip Woods.—It is to be hoped that all readers of this Journal have seen, or will see, Professor Boycott's striking paper in the February number of the *Journal of Ecology*, under the title of "The Habitats of Land Mollusca in Britain". It was of special interest to me that he there gives a list of thirty-seven species to be found in the famous beech woods which clothe the western slopes of the Cotswolds at Birdlip, as I was myself about to spend a week in that neighbourhood. I was able to add two typical woodland species to his list, viz. *Lauria cylindracea* DaC., of which a single specimen turned up among beech leaves at the foot of a moss-covered wall, and *Azeca goodalli* Fér., which occurred among sycamore leaves, at a point where a few sycamores are planted among the beeches. These sycamore leaves were a profitable hunting-ground for other species, notably *Clausilia rolpheii* Leach and *Ena montana* Drap. I failed to find *Arion intermedius* Norm. or *Columella edentula* Drap., which can hardly be absent from the woods altogether. One very beautiful slug is worth recording, a pure white *Arion ater* L. with the head and tentacles black, the effect being even more striking than in the var. *oculata*, in which only the tentacles are black. I was able to confirm another detail upon which Professor Boycott comments. On one stony patch there were hundreds of *Abida secale* Drap., but not a single young specimen, living or dead, was to be seen. Where do the young hide themselves?—L. W. GRENSTED. (Read before the Society, 12th May, 1934.)

Slug and Beetle.—On 24th June, 1934, my attention was drawn to moving objects on the garden path, which upon examination proved to be a Ground Beetle (*Carabus violaceus*) savagely attacking a specimen of *Arion hortensis*. On lifting the beetle from the ground the slug was dropped, but upon replacing the beetle on the path about 3 or 4 inches from its prey the insect at once ran up to it and began to bite it about the middle of the body. This attack lasted for about three minutes, by which time the slug was dead, and ultimately the beetle wandered away to the cover of some pieces of timber. Evidently this is a very useful kind of beetle to keep in a garden.—C. H. MOORE. (Read before the Society, 8th September, 1934.)

NON-MARINE SHELL-DEPOSITS IN YORKSHIRE (N. RIDING) AND DURHAM.

By A. S. KENNARD, A.L.S., and B. R. LUCAS, F.G.S.

(Read before the Society, 7th May, 1932.)

THE following account deals with some interesting shell-deposits at Kirby Fleetham, Oxney Fields, and Cockerton :—

I. KIRBY FLEETHAM.

The village of Kirby Fleetham is situated on Sheet LV, South-West Yorkshire (North Riding). The *Chara* marl deposit is found in the area bounded on the west by the Moorhills plantation, the mill-beck to the south, Fleetham Lane to the east, and a little beyond the Hall Garth (old moated Hall) to the north. The owner, Mr. E. H. Courage, deepened a drain running due east, about 350 feet from the Hall Garth, and in doing so cut through the *Chara* marl bed in its greatest depth. The lake must have had an area of approximately 60 acres and all around the margins you come to sand and gravel of glacial deposit.

The lake appears to have passed through periods of desiccation, and the *Chara* marl is interlarded with small bands of peat. The writers collected the following thirty-nine species of shells :—

- Bithynia tentaculata* (Linn.). Rare.
- Valvata piscinalis* (Müll.). Common.
- „ *cristata* Müll. Common.
- Carychium minimum* Müll. Rare.
- Limnæa pereger* (Müll.). Common.
- „ *palustris* (Müll.). Common.
- „ *truncatula* (Müll.). Rare.
- Planorbis planorbis* (Linn.). Rare.
- „ *carinatus* Müll. Rare.
- „ *corneus* (Linn.). Rare.
- „ *albus* Müll. Rare.
- „ *crista* (Linn.). Common.
- „ *complanatus* (Linn.). Common.
- Ancylus lacustris* (Linn.). Rare.
- Physa fontinalis* (Linn.). Common.
- Pupilla muscorum* (Linn.). Rare.
- Vertigo antivertigo* (Drap.). Common.
- „ *pygmæa* (Drap.). Rare.
- „ *genesii* Gred. Rare.
- „ *moulinsiana* (Dupuy). Rare.
- Vallonia pulchella* (Müll.). Rare.
- „ *excentrica* Sterki. Rare.

- Vallonia costata* (Müll.). Rare.
Cochlicopa lubrica (Müll.). Rare.
Arion sp. Rare.
Petasina fulva (Müll.). Rare.
Zonitoides nitidus (Müll.). Rare.
Retinella radiatula (Ald.). Rare.
Vitrea crystallina (Müll.). Rare.
Limax sp. Rare.
Trochulus hispidus (Linn.). Rare.
Arianta arbustorum (Linn.). Rare.
Cepæa nemoralis (Linn.). Rare.
 „ *hortensis* (Müll.). Rare.
Succinea pfeifferi Rossm. Rare.
Sphærium corneum (Linn.). Rare.
Pisidium nitidum Jenyns. Common.
 „ *milium* Held. Common.
 „ *obtusalastrum* B. B. Wood. Common.

This is a most interesting series and is a record of events hitherto unsuspected. There is first the series of true marl shells. These are all freshwater and are all common in the deposit. They are *Valvata piscinalis*, *V. cristata*, *Limnæa pereger*, *Physa fontinalis*, *Planorbis crista*, *P. complanatus*, and the three species of *Pisidia*. From the thickness of the deposit it is clear that the marl period lasted a considerable time, but a change of conditions led to the cessation of the deposition of the marl and a different association of freshwater forms occurred: later it became a marsh with the usual land-shells. The age of the marl is probably early Holocene while the peaty earth represents the period from that to the present time. Of particular interest is the occurrence of *Vertigo genesii* and *V. moulinsiana*, which are unknown in a living state in Yorkshire.

2. OXNEY FIELDS.

They are situated on Sheets LV and LVII of the 6 in. Ordnance Survey of Durham and form a peninsula at the junction of the Rivers Tees and Skerne. Seventeen years ago the land, that had been looked on as derelict, was drained after pumping for over a year, and the level of the water so lowered as to make it possible to cut drains. In the dried, more or less peaty soil the writers found the following eleven species of shells:—

- Limnæa stagnalis* (Linn.).
 „ *truncatula* (Müll.).
Planorbis leucostoma Mill.
Vertigo pusilla Müll.

Vertigo antivertigo (Drap.).
 „ *pygmæa* (Drap.).
Vallonia excentrica Sterki.
Retinella radiatula (Ald.).
Vitrea crystallina (Müll.).
Trochulus hispidus (Linn.).
Succinea pfeifferi Rossm.

There is no clue as to the age of this deposit, which clearly represents a marsh. The reclaimed land covers about 40 acres, and is in close proximity to the famous "Hell Kettles".

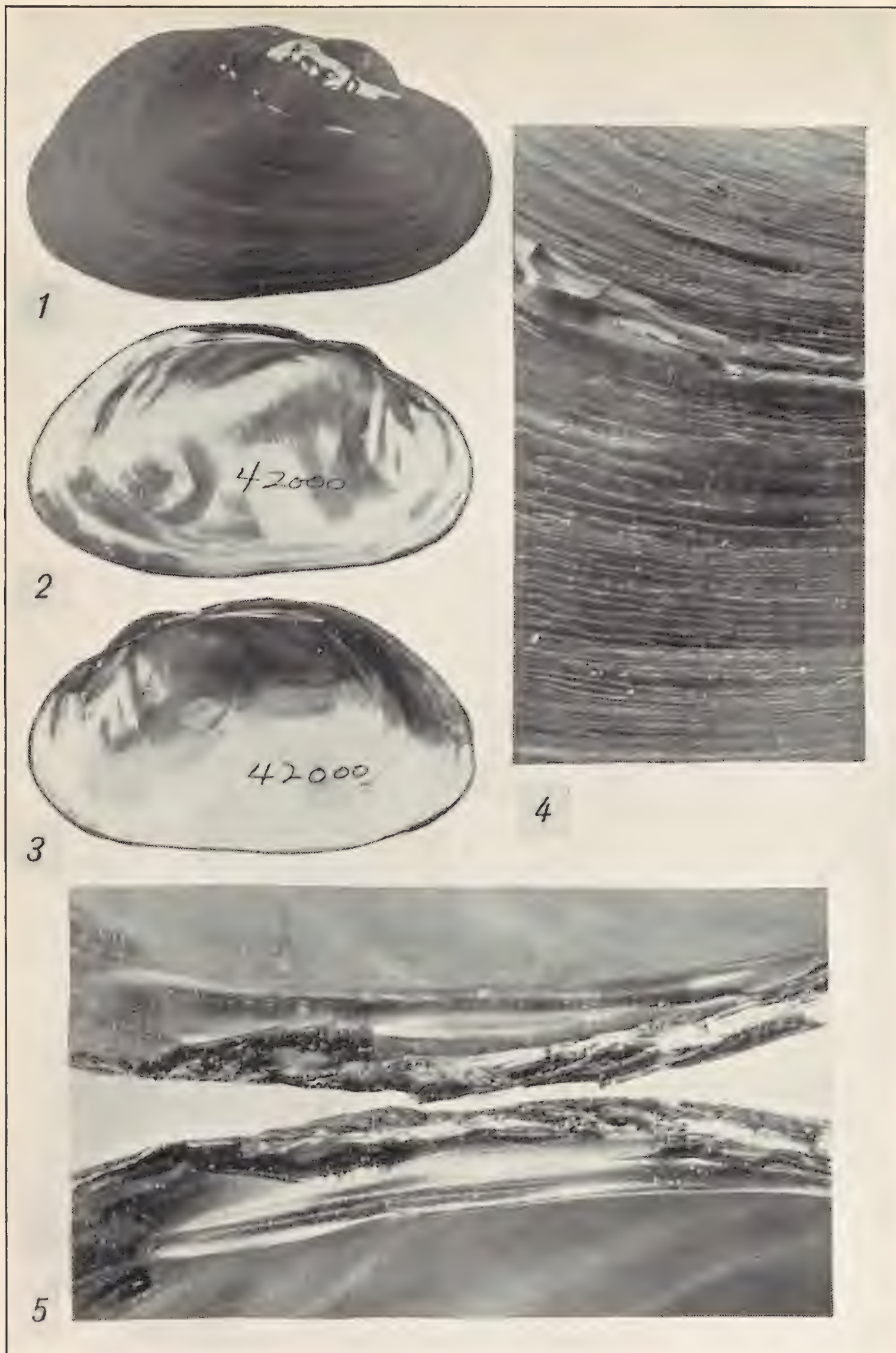
3. COCKERTON (DURHAM).

Cockerton village is situated to the east-north-east of Darlington on the 6 in. map, Durham LV, north-west, of the Ordnance Survey. The ponds, which were brought to the notice of Messrs. E. O. D. Sibson and B. R. Lucas in December, 1931, were found in laying down a drain and new road in continuation of Bates Avenue to the north of Cockerton nearly at the foot of Elvert House.

A thick clay containing shells was discovered, unmistakably old ponds. The drain cut through 25 feet of this deposit at a depth of 5 feet from the surface of the meadow and 6 feet thick. The area of the deposit could not be ascertained, but according to the foreman it spread beyond the road and appeared to consist of two ponds. Fourteen species occurred, viz. :—

Limnæa pereger (Müll.).
Planorbis arcticus Beck.
 „ *crista* (Linn.).
 „ *leucostoma* Mill.
Vertigo parcedentata Al. Braun.
Columella columella (Benz).
Vitrina pellucida (Müll.).
Trochulus hispidus (Linn.).
Succinea pfeifferi Rossm.
Pisidium cinereum Ald.
 „ *pulchellum* Jenyns.
 „ *nitidum* Jenyns.
 „ *subtruncatum* Malm.
 „ *hibernicum* West.

This is clearly a late Pleistocene deposit as is shown by the occurrence of the three extinct species *Planorbis arcticus*, *Vertigo parcedentata*, and *Columella columella*, and this is the first record of these species in the North of England. The fauna is identical with that of the Ponders End stage in the South of England.



HYRIDELLA BARDWELLI CLENCH

- Fig. 1 : Exterior view, holotype, nat. size.
 Figs. 2-3 : Interior view, paratype, nat. size.
 Fig. 4 : Sculpture, holotype. $\times 6$.
 Fig. 5 : Hinge plates, paratype. $\times 3$.

Photographs by F. P. Orchard.

A NEW HYRIDELLA (MUTELIDÆ) FROM AUSTRALIA.

By WILLIAM J. CLENCH.

(Read before the Society, 8th September, 1934.)

[PLATE 2.]

Hyridella (Hyridella) bardwelli, sp. nov.

Shell oblong-ovate to elliptical, inequilateral, inflated, thin and shining. Beaks elevated, full and smooth. Young specimens show a broad and shallow indentation on the uppermost portion of the beaks, which is not indicated in the older specimens. Posterior ridge low, rounded and inconspicuous. Dorsal outline somewhat arched, basal outline somewhat flattened. Anterior end regularly rounded, posterior end irregularly rounded to subtruncated, and somewhat produced a little below the mid-line. Periostracum a deep, blackish brown, olivaceous green in transmitted light. Radial sculpture of very faint, thread-like lines, visible in both transmitted and reflected light. Concentric sculpture of fine growth lines, a few specimens showing a series of hair-like threads that are connected with fine, radially arranged riblets. Areas in which the radial riblets occur, however, are irregularly placed, and not present on all specimens. Rest periods indicated in transmitted light by darkened, concentric lines at about 5 mm. intervals. Teeth delicate, pseudocardinals double in the right valve, and not quite parallel, thickened at their distal ends. The left valve possesses a single pseudocardinal, somewhat irregularly pointed. Laterals single in the right valve, double and nearly parallel in the left valve. Nacre, bluish white, opalescent, most strongly so at the posterior end of each valve where, in addition, there is a somewhat coppery stain. Interior of all shells stained with "oil spots" or Tullberg's layers. Exterior areas of the umbones badly corroded.

<i>Length.</i>	<i>Height.</i>	<i>Width.</i>	
54	31	17.6 mm.	Holotype
54	29	19.5	Paratype
52.5	27	18	"
53	29	18	"
50.2	25.5	17.5	"
49	26.5	16	"

Holotype.—Museum of Comparative Zoology, No. 41999, lower reaches of the Glenelg River, Kimberley Division, Western Australia. Beresford Bardwell collector, 1933. Twelve paratypes, No. 42000, from the same locality, one of which is deposited in the South Australian Museum.

Remarks.—A recent publication by Cotton and Gabriel on the Australian Unionidæ (*Proc. Royal Soc. Victoria*, **44**, pt. 2, pp. 155–160, pl. 16, April, 1932) has made possible a much better understanding of the freshwater clams of that continent. Thiele has, however (*Handbuch der Systematischen Weichtierkunde*, Jena, **3**, p. 838, 1934), placed all of the Australian species in the family Mutelidæ and not the Unionidæ as considered by the above authors.

This new species appears to be quite different from all other Australian forms. The lack of beak sculpture places this species in *Hyridella* s.s.; its outline and thin structure infer a relationship with *H. wilsoni* (Lea) of central and northern Australia. Nothing, however, is known of its soft parts. From this species it differs in being deeper between the beaks and the basal margin, more inflated and not possessing a parallel dorsal and basal outline. In colour as well it differs in being very much darker. Comparative measurements between shells of about the same length are as follows:—

<i>Length.</i>	<i>Height.</i>	<i>Width.</i>		
52	24.5	13.5 mm.	<i>wilsoni</i>	Holotype
52.5	27	18	<i>bardwelli</i>	Paratype

This particular series is heavily stained with the so-called “oil spots” or Tullberg’s layers, a condition more or less induced by the particular nature of the habitat. Freshwater clams living in mud, especially containing any amount of decaying organic material, are usually found to be much corroded by the organic acids in their medium. To protect themselves from the corrosive action, deposition of these oil spots occurs on the inner surface of the valves. The composition of the oil spots is of the same chemical material that is used to produce the periostracum (Altnöder, K., *Arch. Hydrobiol.*, **17** (3), pp. 423–491, pl. 3, fig. 10, 1926). These spotted areas are usually disc-shaped and occur most abundantly in the region of the umbones, the outer surfaces of which are most deeply corroded.

A NEW HOLOCENE DEPOSIT IN CO. DOWN.

By R. MACDONALD.

DURING May of last year I discovered an interesting Holocene deposit of land-shells on the foreshore at Groomsport, Co. Down, less than a quarter of a mile east of the village, from which I was able to obtain the following species: *Cochlicopa lubrica* (Müller), *Clausilia rugosa* Draparnaud, *Trichia hispida* (Linné), *Vallonia pulchella* (Müller), *Cochlicella acuta* (Müller), *Cepaea nemoralis* (Linné), all frequent; *Vertigo angustior* Jeffreys (5), and *Pupilla muscorum* (Linné) (1).

I again visited the section in May of the present year when I was able, owing to the erosion, to determine the following as a typical section: Height of top of section, 22 ft. 6 in. above Ordnance Datum.

(1) Recent surface soil, 16 inches.

(2) Blown sand with land-shells, 3 ft. 7 in.

(3) Black layer, probably Neolithic, 10 inches, which contained the following species of marine shells: *Patella vulgata* Linné, frequent; *Littorina littorea* (Linné), frequent; *Littorina littoralis* (Linné), a few only; *Buccinum undatum* Linné, a few broken specimens; *Paphia rhomboides* (Pennant), one perfect valve. It also contained bones of the following domestic animals which have been identified by Dr. J. W. Jackson: Horse, Ox, Pig, and Goat, together with a few specimens of *Trichia hispida*.

(4) Blown sand coarser than layer (2) but containing the same molluscan fauna. I could not determine the depth of this layer owing to the presence of talus.

The presence of *Vertigo angustior* Jeffreys in this deposit is of great interest as it has not been hitherto recorded from Co. Down either in the living or fossil state, although living in the adjacent county of Antrim. It has probably become extinct in the present situation owing to the encroachment of the sand over a coastal marsh as has been suggested by Stelfox (1) with regard to its disappearance from several other Irish localities where it is now found only as a fossil.

For other references to the occurrence of *Vertigo angustior* in Ireland as a fossil see the recent paper by D. K. Kevan in *The Irish Naturalists' Journal*, vol. 4, p. 178, May, 1933, in which both its recent and fossil distribution is recorded as known up to the present.

Another deposit of the same type existed several years ago at Orlock Point, about a mile and a half further round the coast near

Donaghadee from which the following were determined by Kennard and Woodward (2): *Retinella nitidula* (Drap.), (1); *Trichia hispida* (L.), (7); *Cochlicella acuta* (Müller), common; *Cepæa nemoralis* (L.), (3); *Clausilia rugosa* (Drap.), (1); and *Cochlicopa lubrica* (Müller), (3).

All these species with the exception of *R. nitidula* also occurred in the deposit above described.

BIBLIOGRAPHY.

- (1) Stelfox, A. W., *Proc. Roy. Irish Acad.*, 29, Section B, No. 3, p. 102, 1911.
- (2) Kennard, A. S., and Woodward, B. B., "The Post-Pliocene Non-Marine Mollusca of Ireland," *Proc. Geol. Association*, vol. 28, p. 133.

EDITORIAL NOTES.

THE Society has suffered a very heavy loss by the death of Dr. R. F. Scharff, who was to all intents and purposes an original member. By the courtesy of Mr. R. Lloyd Praeger I am able to give some account of Scharff's life, and I should like to thank Mr. Praeger on behalf of the Society.

Another death much to be deplored is that of William James Wintle, a member of our Society, which occurred suddenly on 26th July last. He was an author and journalist by profession, and had been for many years on the editorial staff of the Amalgamated Press.

News has just been received of another very serious loss—that of our most recently appointed Honorary Member, Dr. Alfred Hands Cooke, on 28th November. Dr. Cooke is perhaps best known as the author of the *Molluscs* in the Cambridge Natural History series. He has been Vicar of Mapledurham since 1920, and from 1900 to 1920 was headmaster of Aldenham School. He only survived his wife three weeks.

In his report on the work of the Government Laboratory for the year ended 31st March, 1934 (H.M. Stationery Office, London, 1934, 9d. net), the Government Chemist, Sir R. Robertson, refers to a curious incrustation on the surface of stored marine shells, which was found to consist of calcium acetate associated with traces of common salt, and appeared on marine shells but not on land shells nor on marine shells covered with a layer of vaseline. The shells had been stored in drawers of oak wood, which is known to evolve traces of acetic acid continuously, and the effect could be traced to the localized action of acetic acid attracted by the deliquescent residue from sea-water salts on the shells.

The South African Fisheries and Marine Biological Survey Report, No. 10 (1932-3), pp. 20, 21, mentions the occurrence of a species of *Pleurotomaria* which has provisionally been assigned to *P. quoyana* F. & B. Two specimens have been trawled in about 200 fathoms, and have been presented to the Durban and to the Cape Town Museums. The larger specimen is described as being 118 mm. in altitude by 115 mm. in breadth of base; the smaller as 65 × 90. These figures seem to represent shells of remarkably different proportions if they belong to the same species.

The *South Australian Naturalist*, vol. xv, p. 113, September, 1934, publishes an account of a Black Duck, *Anas superciliosa*, which was shot with a live specimen of *Hyridella australis* attached to one foot. The mussel was adhering so firmly that the toe-bone of the bird was actually crushed by the pressure of the valves. A photograph of the foot with shell attached is given natural size. The *Hyridella* weighed $2\frac{1}{2}$ ounces.

The Marine Recorder asks me to publish the following communication with reference to the Marine Census. It calls attention to an important modification of method, in that members are no longer invited to submit their actual specimens unless the Recorder asks to see them.

"The question of the best methods of collecting information as to the distribution of the marine species of Great Britain and Ireland was considered by the Council on 13th October. It was decided that if members would send lists of species to the Recorder it would not generally be necessary to forward specimens as well. Should the Recorder think it necessary to inspect any particular species, these could be sent to him at his request. It was decided that a serious effort should be made this year to expedite this important work.

Members and others are asked to help in this matter in the following ways :—

- (1) By sending particulars of species in their own collections.
- (2) By collecting and observation in any particular areas to which they have, or have had, access.

It is felt that rapid progress could be made by these methods. The value of the work would be greatly increased if helpers would include ecological information, such as associated animals and plants, geological formation of the habitat, exact dates, nature of the water, etc.

During the last two years a few zoologists and collectors have sent a limited quantity of information of this kind.

Dr. L. B. Langmead sent such information on *Hydrobia ulvæ* (Pennant) and Miss Nora Fisher on *Patina pellucida* (Linné).

Most of the lists sent in the past have been lists, pure and simple. It is not generally recognized that information about *all* species, rare or common, is wanted.

The Council and the Recorder will be grateful for any help in this matter".

ALAN P. GARDINER,
Marine Recorder,
Kiln Coppice,
Bradfield College,
Berks.

By an unfortunate oversight in our last number the millimetre scale photographed with the shell on Plate I was cut off in preparing the block, and the new species, *Lucina odontotis* (see p. 58), appeared without dimensions. They are as follows: Dorsal margin to beaks, 27 mm.; anterior to posterior margin (maximum distance), 27.5 mm.; thickness (two valves), 16 mm.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND.

615th Meeting, held at the Manchester Museum, 10th February, 1934.

Mr. G. C. Spence in the chair.

Exhibits.

By Mrs. Morehouse : Large series of *Cypræa*, including *C. gillei* Jouss., from Fiji ; *C. vaticina* Iredale, Port Jackson ; *C. scurra* Gmelin, Queensland ; *C. erronea*, L., Indian Ocean ; *C. sophiæ* Braz., New Georgia, Solomon Is. ; *C. comptoni* Gray, S. Australia ; *C. notata* Gill, Broome, W. Australia ; *C. ziczac* L., Queensland ; *C. xanthodon* Gray, Queensland ; *C. nashi* Iredale, Port Jackson ; *C. thersites* Gask., S. Australia ; *C. decipiens* Sm., Broome ; *C. aurantium* Mart., and *C. testudinaria* L., N. Hebrides ; also *Xenophora corrugata* Rve., Hen and Chicken Islands, New Zealand, 25-30 fathoms (one with shells attached and another with a sponge).

By Mr. C. H. Moore : *Mitra*, *Ancillaria*, and *Marginella* ; also British Land Shells (from the J. W. Taylor collection).

By Mr. G. C. Spence : Group of *Bilharzia*-carrying snails from Africa.

616th Meeting, held at the Manchester Museum, 10th March, 1934.

Mr. G. C. Spence in the chair.

Candidate Proposed for Membership.

Tinsley Owen Tippet, Roche Road, Stenalees, St. Austell, Cornwall (introduced by C. P. Richards and J. E. Cooper).

Papers Read.

"A reputed smooth-shelled variety of *Helix aspersa* Müll.," by C. Oldham, F.L.S.

"*Macra stultorum* (L.) in association with *Pinnotheres pisum* Penn.," by J. G. Dalgliesh.

Exhibits.

By Mrs. Morehouse : *Placostylus scarabus* Albers, and *porphyrostomus* Pfr. ; dissection of *Anodonta cygnea* L., with pearls, from Roundhay Park, Leeds.

By Mr. A. K. Lawson : Japanese toys (birds) made of shells.

By Mr. G. C. Spence : Species of *Blanfordia*—hosts of *Bilharzia*.

By Mr. C. H. Moore : Series of *Oliva*.

617th Meeting, joint with the Yorkshire Conchological Society, held at the Manchester Museum, 7th April, 1934.

Mr. G. C. Spence in the chair.

Seventeen persons present.

Election of New Member.

Tinsley Owen Tippet.

Candidate Proposed for Membership.

Philip Vlasto, Budgemore, Henley-on-Thames (introduced by N. B. Davis and C. Oldham).

Exhibits.

By Miss Nora Fisher : Marrat's type-specimens of *Gladius* (= *Tibia*) *martinii* M. ; *Murex imbricatus* Higgins and Marrat ; *Sconsia barbudensis* H. & M. ; *Lima zelandica*, M. (by courtesy of the Liverpool Museum authorities).

By Mr. C. H. Moore : Special groups from the J. W. Taylor collection.

By Mr. K. Howell : *Limnæa pereger* with yellow bodies, from Saw Wood, Thorner ; *Limax cinereoniger* from Saw Wood, *L. maximus* from Saw Wood, and *Milax gracilis* from garden near railway embankment at Horsforth.

By Mr. G. C. Spence : Smaller species of *Achatina*.

By Mr. A. K. Lawson : *Littorina rudis* M. & R., from Loop Head, Co. Clare, and from Walton-on-Naze ; *L. obtusata* var. *æstuarii* Jeff. from Woodbridge (ex coll. J. C. Dacie).

By Mrs. Morehouse : Series of *Cerithium* and *Epitonium*.

By Mr. F. Taylor : British Non-Marine shells of special interest from many localities.

By Messrs. Emmett and Goodson : Colour varieties of *Helix nemoralis* from Basford, near Leek ; *Planorbis vortex* from Barlaston, near Stoke-on-Trent ; *Limnæa palustris* from Coalpit Ford, near Leek (sets collected in 1914 and 1931 showing marked deterioration in seventeen years) ; *H. virgata* from Bryn Euryn, N. Wales (Sept., 1932) ; and *H. aspersa* from Portslade and Arley Kings, Worcs.

618th Meeting, held at the Manchester Museum, 12th May, 1934.

Mr. G. C. Spence in the chair.

Election of New Member.

Philip Vlasto.

Member Deceased.

Rev. S. Spencer Pearce.

Resignation.

W. J. Eyerdam.

Papers Read.

"The Fauna of Birdlip Woods," by Rev. L. W. Grensted.

"*Isidorella pyramidata* (Sow.)—A Correction," by Dr. H. E. Quick.

Exhibits.

By Mr. C. H. Moore : *Nassarius*, *Nerita*, and *Cerithium* ; also "The Young Collector's Handbook of Shells," by Woodward, price 1d. (no date).

By Mrs. Gill : Cameo of "two griffins drawing a chariot carrying woman playing lyre", Pompeii, cut on *Cassis cornuta*.

619th Meeting, held at the Manchester Museum, 8th September, 1934.

Mr. C. H. Moore in the chair.

Candidates Proposed for Membership.

John G. McWilliams, 121 Cave Hill Road, Belfast (introduced by R. J. Welch and Ronald McDonald).

F. Paolo Agate, Via Alessio Narbone 8, Palermo, Italy (introduced by J. W. Jackson and R. Winckworth).

Albert Henry Smith, 56 Lawson Street, Kettering, Northants (introduced by J. Newton and R. H. Lowe).

Member Deceased.

W. J. Wintle.

Papers Read.

"A new *Hyridella* (*Mutelidæ*) from Australia," by W. J. Clench.

"Slug and Beetle," by C. H. Moore.

"A Note on the Preference of *Patina pellucida* (L.) for *Laminaria digitata*," by Miss N. Fisher.

Exhibits.

By Mr. C. H. Moore: *H. lapicida*, *H. nemoralis*, and *H. arbustorum*, from Dovedale.

By Mr. F. Taylor: Large *Anodonta cygnea* from Fowl-mere, near Thetford, Norfolk; Non-Marine shells from Bolton-le-Sands, including *Vertigo antivertigo*, *Pupilla muscorum*, *Famina cylindracea*, and *Clausilia bidentata*. Also varieties of *Arion ater* from Woodfield Nursing Home, Werneth, Oldham, Lancs.

620th (Annual) Meeting, held in the rooms of The Royal Society, Burlington House, London, W. 1, 13th October, 1934.

The President, Mr. A. P. Gardiner, in the chair.

Twenty-eight other members present.

Election of Scrutineers.

Miss N. Fisher and Mr. H. Worsfold were elected Scrutineers.

Election of Auditors.

Messrs. C. H. Moore and F. Taylor were elected Auditors.

Election of New Members.

J. G. McWilliams, F. Paolo Agate, A. H. Smith.

Member Deceased.

Dr. R. F. Scharff.

Presidential Address.

The President delivered an address on "The Littoral Zone," and a cordial vote of thanks was passed unanimously.

Votes of thanks were also accorded to the authorities of the Royal Society and the Manchester Museum for the use of rooms for meetings.

Election of Officers and Council.

The Officers and Council nominated for 1934-5 were unanimously elected. The list is the same as last year with the following exceptions:—

President, J. Davy Dean; Vice-Presidents, add A. P. Gardiner; Council, Mrs. Morehouse and Miss Fisher instead of J. D. Dean and Rev. G. H. Carpenter.

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CONTENTS.

	PAGE
List of Officers and Council	97
Changes of Address	98
Editorial Notes	98
Ernest William Bowell (1872-1935)—A. E. BOYCOTT	101
The Cephalopods of the Yorkshire Coast (Plates 3-7) — J. A. STEVENSON	102
Locally Extinct Marine Mollusca at Portstewart—Miss N. FISHER	117
Self-fertilization—CHARLES ALLEN	126
Accounts	127

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EDITORIAL NOTES.

IN 1934 this *Journal* completed its sixtieth year of issue, pp. 1-48 of vol. i having been published in 1874.

Once again we have to record serious losses to the Society by death. Dr. E. W. Bowell, who was President in 1931-2, died last month. We hope to publish some short account of his life in this number.

Mrs. G. B. Longstaff, *née* Donald, died at Bath on 17th January, aged 79. She was a very good all-round naturalist in her earlier days and took particular interest in Botany and in the Mollusca. More recently she made a name for herself in Palæontology and her papers on *Loxonematidæ*, a family of Palæozoic Gastropods, are well known to geologists.

In the last line on p. 25 of the current volume of the *Journal* for "Park Lane" read "Park Cave".

The Rev. E. P. Blackburn has just published an admirable "Survey of the Land and Freshwater Mollusca of Northumberland and Durham" (*Tr. Northern Nat. Union*, vol. i, pt. 3, pp. 139-186, Nov., 1934). To our mind these works which gather up the information of previous years in a summary and at the same time a comprehensive form are amongst the most valuable papers that appear. The volume of literature on our subject, already vast enough, is being added to at an amazing rate; the "Mollusca" portion of the *Zoological Record* in the last few years in its annual list of titles has never been below 900 and has twice exceeded 1,000.

The Survey starts with a concise account of the subdivision of the counties, illustrated by two maps which are conveniently inserted in the text and are thus more handy for reference. The great changes, due to drainage of marshes and felling of woodlands, are indicated, and reference is made to Holocene Mollusca.

We shall look forward to the detailed excursus on *Clausilia cravenensis* Taylor, which is promised in a future number.

We should like to call attention to the excellent work now being carried out by Mr. C. H. Moore on the J. W. Taylor collection. During 1934 he labelled and mounted 550 series of shells, and catalogued a large number of the freshwater shells. In the library Mr. Moore has card-indexed and catalogued 380 books and pamphlets, as well as bringing the general library completely up to date. He intends to prepare a catalogue in book form of all donations to the Society.

On p. 92 of our last number a short report is quoted on the well-known shell disease. Thanks to the President, I am now able to give in full a paper by J. R. Nicholls of the Government Laboratory, W.C. 2, on "Deterioration of Shells when Stored in Oak Cabinets", which appeared in *Chemistry and Industry*, vol. 53, no. 51, pp. 1087-8, 21.xii.34:—

"There have been numerous cases recorded of the corrosion of lead and other metals when in contact with oak. Brame (*J. Soc. Chem. Ind.*, 1918, 37, 39) has shown that lead roofing is attacked where it touches oak beams and Southernden (*ibid.*, 1918, 37, 85) records that lead laid on deal remained sound for eighty-five years, whereas that on oak was incrustated in eight years, 7 lb. of lead per square yard being corroded. Dr. Alexander Scott has reported that at the British Museum lead medallions contained in oak museum cases became badly corroded, even though the lead and oak were not in contact, the specimens resting on cardboard slips. He has said ('The Cleaning and Restoration of Museum Exhibits,' *Bulletin No. 5*, D.S.I.R., 1921): 'It is more or less generally recognized that it is unwise to store medals and other small objects of lead in cabinets of oak, but cabinets of mahogany and various other woods are quite safe.'

"The origin of such corrosion is the fact that oak (and certain other hard woods, e.g. teak) continually evolves traces of acetic acid, even when the wood is thoroughly seasoned. Watson (*Chemical Essays*, 1787, 3, 366), commenting on the corrosion of roofing lead, says: '. . . oak contains a much stronger acid than deal, and this stronger acid being distilled, as it were, by the heat of the sun in summer, attaches itself to the lead and corrodes it.' With free access of air the acid vapours are quickly dissipated; but where they are not removed the concentration may soon become sufficient for the acid to attack metals. Water has been shown to be necessary for the action, which increases as time goes on.

"There does not appear to be any recorded instance of substances other than metals being attacked through association with oak, but such a case has recently been investigated.

"The Natural History Museum at South Kensington found that a number of shells which had been stored for long periods had developed a white incrustation, considerably affecting the appearance of the specimens. On a number of occasions this form of deterioration has cropped up and troubled collectors, although it does not appear ever to have become widespread. Suggestions have been made that the attack is due to bacteria but no evidence in support of this has been adduced.

"The Museum authorities requested the Government Chemist to examine the shells, to investigate the cause of the deterioration, and, if possible, to suggest a remedy.

"The shells examined had been attacked to very varying extents. Some were completely covered by the white deposit, whilst others had only small patches visible. In one instance two shells of the same type, which had been mounted on one card, were noticeably different; one was practically unaffected whilst the other had been attacked over almost the whole of its surface.

"The incrustation could not be brushed from the shells but was easily scraped off. It was soluble in water and the surface of the shell, when washed, was seen to have been attacked over the whole area covered by the deposit. From one shell three-quarters of a gram of incrustation was extracted by solution in water. Examination of the extracted matter showed that it

consisted almost wholly of calcium acetate but also contained traces of salt. The acetparatoluide prepared from the incrustation was found to melt sharply at 148° C., pure acetparatoluide melting at the same temperature.

" Microscopical examination of scrapings from the shells showed no mould growth and bacteriological cultures showed no bacteria associated with the deposit.

" It appeared, therefore, that the shells had been in contact with acetic acid which had attacked the carbonate layer of the shell over definite areas, and the resulting calcium acetate showed as a white incrustation.

" As a result of inspection of similar deteriorated shells in their normal storage positions at the Museum and of inquiries made there, the following facts were elicited :—

" (1) The deteriorated shells were amongst those stored for long periods in drawers of which the sides, backs, and bottoms were made of oak.

" (2) The shells were not treated in any way before mounting on cards, except that dirty shells were washed.

" (3) The shells were not lacquered or varnished after mounting.

" (4) The incrustation appeared on marine shells and not on land shells.

" (5) A certain number of shells had been smeared with vaseline and none of these was attacked.

" (6) The atmosphere of the museum is normally dry.

" All the above facts were consistent with the shells having been attacked by the acetic acid emitted from the oak linings of the drawers, but did not explain why some shells were heavily, some lightly, and some not at all attacked. The clue to these differences was found in the traces of salt associated with the incrustation. Washings from shells which showed no sign of attack contained no chlorides whereas washings from incrustated shells gave reactions for chlorides varying with, and roughly proportional to, the area attacked.

" The mechanism of the deterioration therefore appears to be as follows : The oak wood of the drawers continually emits traces of acetic acid and these vapours can only escape with difficulty from the closely fitting drawers. Marine shells retain sea-water which, on evaporation, leaves a small residue of salts ; according to the amount of sea-water and to the porosity of the shells, this residue may be spread over the shell or be located at the place to which the sea-water drains. This residue, being hygroscopic, is in a condition to absorb the acetic acid vapours, which would react with the calcium carbonate of the shell forming the incrustation. Where dirty shells had been washed the salt would be removed and the normal surface of the shell, not being itself hygroscopic, would not absorb the acetic acid and would not be attacked.

" The prevention of such deterioration would appear to be simple. Either oak cabinets should not be used or all shells before being mounted should be washed and dried. Added precautions when oak cabinets are used would be the periodical aeration of the drawers by opening them, and the smearing of the shells with vaseline, if this does not affect their appearance.

" Mention may be made of a further possible source of acid contamination, viz. cotton wool. All cellulose fibres are liable to attack by bacteria, with consequent production of traces of volatile acids if the humidity of the atmosphere reaches a sufficient degree of saturation to cause the fibre to absorb more than a limiting amount of water. In general, the atmosphere of museums would probably be sufficiently dry for this action to be insignificant ; but the possibility should be borne in mind when storing rare or delicate specimens. Even if washed they should not be placed in direct contact with cotton wool ; they may be mounted on soft wood or Bristol board and may, as a further precaution, be lightly smeared with vaseline."

ERNEST WILLIAM BOWELL (1872-1935).

By A. E. BOYCOTT.

E. W. BOWELL was a naturalist from boyhood, and his long and devoted services to Conchology were recognized by his election as President of this Society in 1931. He was the fourth son of the Rev. W. Bowell, of Hereford and Sissinghurst, and was educated at Hereford Cathedral School and Wadham College, Oxford. He afterwards went in for teaching, took Orders in 1900, and was successively a school master at Neston and Leatherhead, and curate of Penshurst. He then left the Church and took to medicine, qualifying from Guy's Hospital in 1917, after which he served in the R.A.M.C. in the East, and when the War was over did medical laboratory work at his hospital and with the Clinical Research Association. His eyesight began to fail in 1930, and his general health became very unsatisfactory soon afterwards; he died on 19th February, 1935, after a long illness.

Bowell was constitutionally a student and a scholar, and a most agreeable and kindly man. He was, especially in his young days, a good field worker, though he was more interested in the anatomy and microscopy of the mollusca than in their biology. He made a particular specialty of their radulæ and spent a great deal of time in working out methods of staining, mounting, and photographing them. In 1908-9 he published a useful description of the radulae of the British helicids (*Proc. Malac. Soc.*, vol. viii, pp. 125, 205, 379), and it is a pity that he never felt ready to carry out his plan to write a complete account of all the British species, for he certainly knew more about them than anyone else, and acted as a general referee on the subject for anyone who cared to supply him with material. In some of his other anatomical work he was less successful, and fell into error about the structure of *Vitrina pyrenaica* and *Limnæa prætenuis*. In our young days we collaborated in an account of the mollusca of Herefordshire (1899), and among a variety of notes and short papers his discovery and description of the form *og* of *Cochlicopa lubrica* (*Proc. Malac. Soc.*, 1917, vol. xii, p. 312) is perhaps worth special notice. His writings are, however, no measure of his good influence, which was exercised more in his talk and letters and in his implacable conviction that natural history was a respectable occupation for any man.

THE CEPHALOPODS OF THE YORKSHIRE COAST.

By J. A. STEVENSON.

(Read before the Society, 9th February, 1935.)

[PLATES 3-7.]

INTRODUCTION.

CONSIDERABLE interest has been aroused in recent years throughout England by the occurrences from time to time along the coast of Yorkshire of several large and rare forms of cephalopods, particularly giant squids. These occurrences, however, have not been confined solely to the larger types, many of the smaller forms having been obtained during the same period. In view of the fact that hitherto no comprehensive study has been made of the cephalopods of the particular region under consideration, it is the purpose of this report to bring in up-to-date and published form the available material and records before the interested public. It is intended that this report will provide a useful basis for further investigation in this field.

Most of the records are of recent origin. The chief sources have been the Marine Biological record-book of the Scarborough Field-Naturalists' Society, the *Victoria History of Yorkshire*, and the records that have periodically appeared in *The Naturalist* (Hull). A very large number of the records was made by Mr. W. J. Clarke, F.Z.S., of Scarborough, who has most diligently and enthusiastically obtained information over a period of many years, and has very kindly placed it entirely at my disposal. Also, specimens have frequently come to the writer's hand, in which cases attempts have always been made, with varying success, to obtain all information possible concerning their capture. In cases where specimens occurred whose identity was doubtful, such specimens, whenever possible, were sent to the British Museum (Natural History), where Mr. G. C. Robson gave great assistance by providing exact identifications.

In order that this report may contain the elements of a guide, a brief description is given of many of the species found in this area, and should be sufficient to identify positively the more common forms. In the case of the rarer and more unusual species, particularly the sepiolids, the members of the Ommastrephidae, and the giant squids (*Architeuthis*), the author would suggest that these be sent as soon as possible after capture to the Department of Mollusca, British Museum (Natural History), for identification. The accurate identification of many species of cephalopods is by no means a simple task ; but if a copy is available, reference may

be made to Hoyle's article, "British Cephalopoda; their nomenclature and identification," *Journ. Conch.*, vol. 10, p. 197 (1902), which contains a key for the identification of the British species.

Cephalopods are actively swimming, predaceous molluscs characterized by the possession of eight or ten sucker-clad arms, highly developed eyes, a horny, parrot-like "beak", and a "funnel". By expelling water from the mantle cavity through this funnel with some force, they are able to shoot at a great speed through the water.

Both demersal and pelagic forms of cephalopods are found off the Yorkshire coast. They are to be found in all types of habitats, ranging from low-tide mark to the deep sea: hence collecting involves many different methods. The shrimpers on the sandy beaches at Filey and Scarborough generally obtain numbers of *Sepiola*; the trawlers in shallow water catch other species, and those trawlers which visit the off-shore banks bring up still other forms, such as *Ommastrephes sagittatus*, characteristic of deeper water. Other species have been found cast up on the shore after frosts and heavy easterly gales.

RECORDS AND OBSERVATIONS.

Order DIBRANCHIA.

Sub-order DECAPODA.

Family SEPIIDAE.

(1) *SEPIA OFFICINALIS* (Linnaeus, 1758). PL. 7, FIG. 1.

Description.—This species is unmistakable both in general shape and the pattern of the colours on its body. The head and body are broad and somewhat flattened, the sessile arms comparatively short. The fins in this animal take the form of a narrow fringe extending on either side of the body from the posterior end approximately to the anterior edge of the mantle, and of nearly constant width throughout its length. This characteristic is unique among Yorkshire cephalopods, and serves to identify the species at a glance. The colour-pattern is remarkable, consisting of a series of dark chocolate bands extending from the sides towards the centre of the dorsal surface. The intervening spaces between these bands are whitish. The head and arms are uniformly chocolate.

Size.—About 1 foot to 1 ft. 6 in. from posterior end to tips of sessile arms.

Occurrence in Yorkshire Waters.—Rare. Formerly, it appears to have been more abundant, because Mr. W. J. Clarke informs me that about twenty years ago it was occasionally to be seen upon the Scarborough fish-market. More recently he obtained a

specimen, trawled 40 miles N.E. of Scarborough, on 1st February, 1932. Shells of this animal are very frequently to be found lying upon the sands of some of our bays, particularly during the winter-time, when some of the more violent easterly gales deposit them in large numbers, and in more or less broken condition, upon the shore. Such was the case during the early spring of 1928, when the South Sands at Scarborough were strewn with them (*Naturalist*, 1st April, 1928, p. 115).

Family SEPIOLIDAE.

(2) SEPIOLA ATLANTICA (Orbigny, 1839).

Description.—Body nearly spherical, the anterior edge of the mantle attached to the head on the dorsal surface. In this it may at once be distinguished from *Rossia*, the only other Yorkshire genus with which it might be confused, since the anterior edge of the mantle in the latter species is free at this point. Fins large, rounded, and extending laterally from the middle of the body, which in some specimens they nearly equal in diameter.

The colour changes of this little cephalopod are very interesting to watch. There is no ground colour, save a slight greenish tinge in the translucent flesh. The chromatophores are relatively large, particularly on the ventral surface. The usual colour is chestnut brown, with a shade of opalescent green over each eye; but the animal is able at a moment's notice to become a pallid white. When the bowl in which the animal is living is put in sunlight, the *Sepiola* becomes dark brown, which changes to white when the bowl is moved to a shaded place.

Size.—Rarely over an inch in total length (excluding the retractile tentacles) in this area.

Occurrence in Yorkshire Waters.—Very abundant just below low-tide mark on our sandy beaches, particularly at Filey, where sometimes in the summer it is caught in the shrimp-nets in large numbers. It occurs in deep water, too, because the writer has occasionally seen it entangled in the nets of the steam-trawlers that work from 7 to 40 miles off the coast.

Habits.—This is a form characteristic of sandy bottoms. It occurs during the summer time close inshore, but in winter appears to retreat to deep water, where the force of the gales cannot reach it. Hence it is during the summer that this species comes to our notice most frequently, when the shrimpers catch it, sometimes in quite large numbers (10–20 per drag or push), in their push-nets and shrimp-trawls.

The following observations were taken from a specimen kept

alive in a small glass bowl of sea-water with sand on the bottom during the summer of 1928. At rest, the animal (which is about three-quarters of an inch long) is nearly buried in sand, with just its eyes and the anterior end of its body showing. The arms are turned downwards and folded backwards along the lower part of the sides of the head. The motions of water-circulation are hardly perceptible when *Sepiola* is at rest, but when it is swimming they are very vigorous. It is interesting to watch *Sepiola* bury itself in sand. It alights, arms downwards, on the sand; and, before the body has come to rest, it blows out a slight depression with its funnel. This done, by directing the funnel backwards it drives the sand from under it, heaping the latter about it. This sand which is blown out is mixed with enormous quantities of a mucous substance, which helps considerably to distribute the sand over the animal. In about two minutes the mucus seems to disappear, and the animal is now covered evenly and smoothly, except for its eyes and the anterior portion of its body, with a fine layer of sand. This is only shaken off when the *Sepiola* begins to swim again, which it does periodically for a short while.

When *Sepiola* is swimming, the large fins are incessantly undulating. They have a screw-like motion, and by means of them the animal is able to travel surprisingly fast through the water. As in the squid (*Loligo*), they serve to elevate the posterior end of the animal, the arms being held in such a position as to act as vanes for elevating the anterior end. The funnel is very long, and can be directed forwards or backwards according to the direction in which the animal wishes to swim. *Sepiola* is able to go quite as fast forwards by directing the funnel backwards as backwards by directing it forwards, motion, of course, being effected by the forceful expulsion of the water contained in the mantle cavity.

(3) SEPIOLA PFEFFERI Grimpe, 1921.

This species has been recorded off Flamborough Head (Lat. $53^{\circ} 35' N.$, Long. $0^{\circ} 32' E.$) by Grimpe, in *Cephalopodenfauna der Nordsee*, p. 19 (1925). We have not seen this species in the Scarborough district, and the local record-book contains no mention of it.

(4) SEPIETTA OWENIANA (Orbigny, 1839).

Though, as with the above species, there is no mention of *Sepietta* in the record-book of the Scarborough Field-Naturalists' Society, it is recorded from both Filey and Scarborough by Hargreaves in the *Journ. Conch.*, Vol. 13, p. 105 (1910), under its synonym, *Sepiola scandica* (Steenstrup).

(5) *ROSSIA MACROSOMA* (delle Chiaje, 1829). FIG. 1.

Description.—This species, which is far rarer along the Yorkshire coast than its relative *Sepiola*, can be distinguished from the latter chiefly by the fact that the anterior edge of the mantle is free all around the body, the fins are relatively much smaller and quite thick, and the size is considerably greater. The colours of the only two specimens we have seen were purplish-brown and a pallid white. In the purple specimen the chromatophores were somewhat small and set close together.

Size.—The maximum has been set at 10 inches from the posterior end of the mantle to the tips of the retractile tentacles. Specimens of this size, however, are extremely rare, and a specimen of 5 inches must be considered exceptional.



FIG. 1 : *Rossia macrosoma* (delle Chiaje).

Occurrence in Yorkshire Waters.—We have only three records of its occurrence, all from deep water :—

(a) A specimen trawled by the *S.T. Expert*, 8 miles north of Scarborough (opposite Hayburn Wyke) on the “hard grounds” (about 25 fathoms). Received on 2nd November, 1927. Identified by Mr. Robson, and deposited in the British Museum. The mantle of this individual was 41 mm. in length. Colour when fresh, purplish-brown. Vide *Naturalist*, 1st January, 1928, p. 25.

(b) A female specimen caught in a Danish plaice seine off

Whitby and landed at Scarborough (steam drifter *Silver Line*). Received 8th May, 1928. Identified by Mr. Robson and deposited in the British Museum collection. Length of mantle, 54 mm. Total length when fresh (tip of mantle to tips of retractile tentacles) 10 inches. This specimen is the largest of this species ever examined by Mr. Robson, and probably represents the maximum size to which this animal grows. Vide *Naturalist*, 1st August, 1928, p. 238.

(c) A specimen taken from the stomach of a codfish caught 12 miles north-east of Scarborough, on 4th March, 1933 (Clarke MS.).

None of the fishermen to whom these two specimens were shown had seen the like of them before ; and this coupled with the scarcity of records leads us to believe that this species is rare along the Yorkshire coast. It is, however, a comparatively small, deep-water form ; and it is possible that it may be locally abundant and hitherto overlooked. Both (a) and (b) came from sandy bottoms not very far off-shore, so it is possible that some of the in-shore trawlers obtain them more frequently than we are led to believe, sandy bottoms being suitable for trawling. If a sharp look-out were kept for them, it is believed that further specimens would be forthcoming.

Family LOLIGINIDAE.

(6) *LOLIGO FORBESI* (Steenstrup, 1856).

This species can be distinguished from the other Yorkshire forms by the shape of the fins and their position on the mantle. These extend from the blunt posterior end up to a point about three-quarters of the way towards the anterior edge of the mantle. They are obtuse and rounded : broad, extending outwards on either side of the animal as far as the width of the mantle. Young specimens can be distinguished from *Alloteuthis*, the only genus here likely to cause confusion, by the absence of a marked attenuation of the posterior end of the mantle. In *Loligo* this is somewhat blunt and rounded ; whereas in *Alloteuthis*, particularly in the male, it is much elongated and tapered to a point.

Loligo is capable of a wide range of colour change. The flesh is translucent when alive, and there is a greenish tinge around each eye. The chromatophores are capable of considerable expansion, and in this state render the squid reddish-brown in colour. Contracted, they are so small as to be unnoticeable against the translucent whitish flesh, and the living squid appears beautifully opalescent. It is capable of assuming all the wide range of shades between these two extremes.

Specimens of this squid up to two and a half feet in total length

(excluding the retractile tentacles) are not uncommon off the Yorkshire coast. The average size, however, might be stated at from 8 to 12 inches.

This is the real "squid" of the fishermen, and is probably the most abundant cephalopod frequenting the coastal waters of Yorkshire during the summer and autumn. It does not appear to be caught close in-shore at any time by the fishermen, but at times large numbers are taken in the nets of trawlers fishing from 7 to 15 miles off-shore. In such cases these squids are used extensively for bait by the fishermen. They are considered to be the bait *par excellence* for cod and ling.

Loligo when taken in the trawl is usually too mutilated by contact with sea-urchins, etc., to survive until it reaches the surface, hence the writer has not been afforded opportunity of studying it alive. The evidence goes to show that spawning along the Yorkshire coast takes place during the late summer (August), because we have found at about that time large masses of the egg-capsules of this species on the Filey sands. One bunch of these capsules, taken in a beam-trawl (of the type used by the fishermen in catching soles) in Filey Bay contained 79 capsules, all of which exceeded 4 inches in length (8th August, 1928). Several bunches, when placed in sea-water, released numbers of young squids almost immediately. Exposure of the capsules to air seemed to accelerate the speed of hatching of the young squids, which swam about vigorously as soon as they had freed themselves from the gelatinous capsules.

Loligo, particularly young specimens, forms an important part of the food of the Wolf-fish (*Anarhicas lupus* L.) during the summer time, since the stomachs of these fish are generally found to contain large numbers of them.

(7) ALLOTEUTHIS SUBULATA (Lamarck, 1799). PL. 3.

Loligo subulata Lamarck, 1798.

This small species can generally be distinguished at a glance by its much attenuated form. In the male, the posterior end of the mantle is tapered to a point about as far behind the posterior ends of the fins as the distance from their anterior ends to the anterior edge of the mantle. The female is only attenuated for a short distance beyond the fins—about half the length of the latter. The fins are rounded and obtuse. Eyes large.

Colour in life probably much like that of *Loligo*. Since all the specimens we have received have been dead, it is not easy to say, but the colours of these specimens have very much resembled those of dead *Loligo* of about the same size.

Males are generally larger than females, being on the average about 6 inches in total length (excluding the retractile tentacles). This includes the tapered "tail". Females do not generally exceed $4\frac{1}{2}$ inches, rarely 5.

Occurrence in Yorkshire Waters.—*Alloteuthis subulata* is probably the most plentiful cephalopod found off the coast of Yorkshire during the winter and early spring. It is particularly abundant at this time in the deeper off-shore waters (40 fathoms and down), and is occasionally taken in very large numbers in the trawl-nets. The fishermen inform us that these small squids have a habit of clinging to the exterior of their nets, sometimes in such large numbers that the nets appear quite white with them. They never reach the surface alive, we are told; and are generally quite mutilated by then. Hence living specimens have not been available for study. Vide *Naturalist*, 1st January, 1928, p. 23.

That this species forms an important article in the food of such fishes as cod, ling, and wolf-fish is evidenced by the fact that many of the stomachs of these fish, upon being opened, were found to contain the partially digested remains of *Alloteuthis*, sometimes in large numbers.

The shrimpers at Filey have informed us of a small, much attenuated squid of about the size of *Alloteuthis* that they occasionally catch at low spring tides in their push-nets. We have not been able to procure a specimen, but, as *Alloteuthis* does occur between tide-marks on our southern coasts, it seems probable that these are referable to this species. On this coast, however, *Alloteuthis* appears to be more of a deep-water species.

Family OMMASTREPHIDAE.

(8) OMMASTREPHESES SAGITTATUS (Lamarck, 1798). PL. 4.

Loligo sagittata Lamarck, 1798.

Todarodes sagittatus (Lam.) Steenstrup, 1880.

Mr. Winckworth has communicated to me the following note upon the nomenclature of the *Ommastrephidae* :—

"*Ommastrephes*.—Hoyle and his successors are wrong in using this name for the *sagittata* group, as *L. sagittata* Lamarck is not among the original species of *Ommastrephes*. The type of *Ommastrephes* is *O. bartramii* (Lesueur) which is closely allied to *Caroli* and is a *Sthenoteuthis*. As the earlier name *Ommastrephes* should be used instead of *Sthenoteuthis*, *Todarodes* can be used for the species *sagittatus*."

The Ommastrephid specimens mentioned in this paper have been recorded in various periodicals (*The Naturalist*, etc.) hitherto

under the older system, viz. *Ommastrephes sagittatus*, *Sthenoteuthis caroli*, etc., and it is felt that in order to avoid confusion it would be simpler to adhere to these names, which I have done.

This species can be distinguished from all other common Yorkshire forms by its large size, its brick-red colouration, and by the shape of its pen, which is tapered throughout its length, and broadened at its posterior extremity into the shape of an arrowhead. The angle of the fins is acute. Large specimens of this animal are liable to be confused with small *Sthenoteuthis*; hence it is advisable to send such to an expert for proper identification, if possible.

Size.—The smallest specimen we have known from this district was 17 inches in total length; and the largest 45 inches (tip of longest tentacles to posterior end of mantle). A fairly average size is about 24 inches.

Like *Sthenoteuthis*, this squid seems subject to stranding on the shore. It appears to fluctuate very widely in abundance from year to year. It had not been recorded for this area until the summer of 1928, when large numbers appeared suddenly off the coast. Since then, they have occurred in greater or less numbers up to the present time (1933). *Ommastrephes* appears to be most abundant 30 to 40 miles off-shore, but some specimens have from time to time been found cast-up on the beaches. The following list is, we believe, a complete one to the present time for the recorded instances of these strandings:—

- (a) 19th March, 1928. Male, Cayton Bay sands. Deposited in the British Museum. (Clarke.)
- (b) 28th November, 1928. South Bay, Scarborough. 44 inches long. Deposited in British Museum. (Clarke.)
- (c) 22nd March, 1929. South Bay, Scarborough. 18 inches long. (Clarke, in lit.)
- (d) 22nd March, 1929. South Bay, Scarborough. $18\frac{1}{2}$ inches long. (Clarke, in lit.)
- (e) 22nd March, 1929. South Bay Scarborough. 20 inches long. (Clarke, in lit.)
- (f) 10th April, 1930. South Bay, Scarborough. 18 inches to tips of sessile arms. Deposited in British Museum. (Clarke, in lit.)
- (g) 4th May, 1930. Scarborough. 32 inches long. Deposited in British Museum by Mr. F. D. Taylor, of Scarborough.
- (h) 19th May, 1931. South Bay, Scarborough. 37 inches long. Deposited in the Scarborough Museum. (Clarke.)
- (i) and (j) 13th May, 1931. South Bay. "Both about 3 feet long." Unidentified, but probably of this species. (Clarke.)

- (k) 4th August, 1932. Scarborough. 3 feet in total length.
(Clarke.)
- (l) 11th March, 1933. North Sands, Scarborough. Female,
3 ft. 11 in. over all. Deposited in British Museum.
(Clarke, in *Naturalist*, 1st July, 1933, p. 162.)
- (m) 31st March, 1933. South Bay, Scarborough. Male, 34 inches
over all. Deposited in the Hull Museum. (Clarke, in
Naturalist, 1st July, 1933, p. 162.)

In addition to these, there are some records of the capture of *Ommastrephes* in the trawl-nets :—

- (n) 2nd April, 1928. 25 miles off Scarborough. 24½ inches long.
(Stevenson.)
- (o) 10th October, 1930. 12 miles north of Scarborough. 45 inches
long. Deposited in British Museum. (Clarke.)
- (p) During the summer of 1928 many specimens of *Ommastrephes*
sagittatus were trawled on the off-shore grounds and
brought into Scarborough. Those seen by the writer
measured from 17 to 39½ inches in length. (Stevenson,
in *Naturalist*, 1st August, 1928, p. 238.)

It is probable that in the many secluded bays along the coast specimens have from time to time been stranded and have escaped our notice. This squid is apparently quite abundant at times off the Yorkshire coast, though we believe 1928 to have been a year of exceptional abundance.

Local names : “ Red squid,” “ Cuttlefish.” The latter name is in contrast to “ squid”, which most of the fishermen apply only to *Loligo*. They say that red squids are of no use as bait, and usually throw them overboard with the rest of the “ rubbish”, after the contents of the cod-end have been sorted.

(9) *TODAROPSIS EBLANAE* (Ball, 1841). PL. 5.

Loligo eblanae Ball, 1841.

This species can most readily be distinguished from other local members of the Ommastrephidae by its small size and the relatively great width of its fins. Its great rarity, however, makes it advisable for expert authority to be had upon its identity, should likely specimens occur.

The only specimen we have seen measured 10 inches from the tip of the mantle to the ends of the retractile arms.

One record ; a typical male with both ventral arms hectocotylized. Taken in the trawl off Robin Hood's Bay, and put into a jar of formalin that the writer had placed on board the trawler. This specimen was received on 9th April, 1928 (Stevenson, in *Naturalist*, 1st August, 1928, p. 238). Deposited in the British Museum.

The fact that the fishermen had never seen the like of the above specimen, and the small number of records (two, we believe, with locality, including the above, for the North Sea), indicate that this animal must be very rare in this vicinity. It is said to be more plentiful off the Atlantic coast of the British Isles.

(10) *STHENOTEUTHIS CAROLI* (Furtado, 1887). PL. 6, FIG. 1.

Ommastrephes caroli Furtado, 1887.

Sthenoteuthis bartramii (Lesueur, 1821). (teste Hoyle, 1909).

The identification of the giant squids is a matter of some difficulty, and should be undertaken only by an expert. No descriptions of this and some of the following species are given in this paper. All specimens obtained should be despatched as soon as possible after death to the British Museum for correct diagnosis.

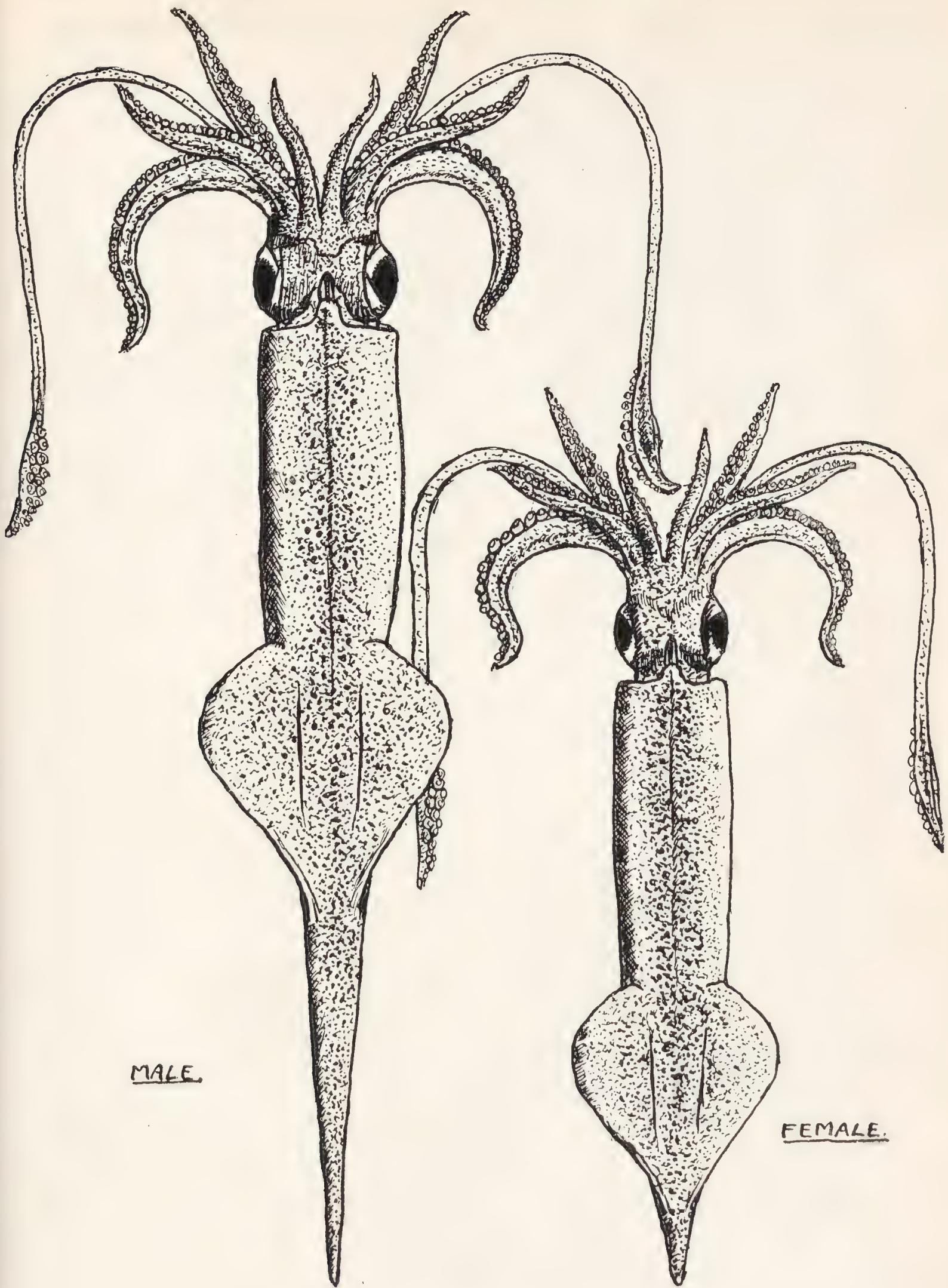
The remarkable occurrences of this giant squid in the vicinity of Scarborough during recent years have aroused much interest in scientific circles, and have been well summarized by Clarke and Robson ("Notes on the stranding of giant squids on the north-east coast of England," *Proc. Malac. Soc., London*, vol. xviii, part iv, March, 1929). They are as follows:—

(a) 3rd January, 1925. A specimen, 7 ft. $1\frac{1}{2}$ in. in total length, was cast up on the shore at Withernsea, "in a dying condition." After being exhibited at that town and photographed, it was sent to the British Museum (Robson, in *Proc. Zool. Soc.*, 1925, p. 291).

(b) 18th March, 1927. A specimen, 5 ft. 7 in. in total length, was found stranded on the rocks at the northern end of North Bay, Scarborough; and ultimately, through the thoughtfulness of Alderman Whitehead of that town, secured from the danger of being cut up as bait by fishermen. It was photographed, and exhibited to a large number of sightseers; and was eventually deposited in the British Museum, where a cast was made of it. This specimen was in quite good condition.

(c) 1st February, 1928. A specimen found by my brother at high-water mark upon the rocks in South Bay, Scarborough. No measurements were taken, but its length, not including "tentacles", was estimated at 3 ft. 6 in., the total length being about $4\frac{1}{2}$ feet. The head with the tentacles was sent to the British Museum, where it was identified with this species by Mr. Robson. It had been considerably mutilated by prowling rats on the shore. (See *Naturalist*, July, 1928.)

(d) 9th January, 1930. A female specimen, 3 ft. 9 in. long to tip of short arms, stranded at Filey (W. J. Clarke, in *Naturalist*, 1st April, 1930). Deposited in the British Museum.



MALE.

FEMALE.

Alloteuthis subulata (Lamarck).

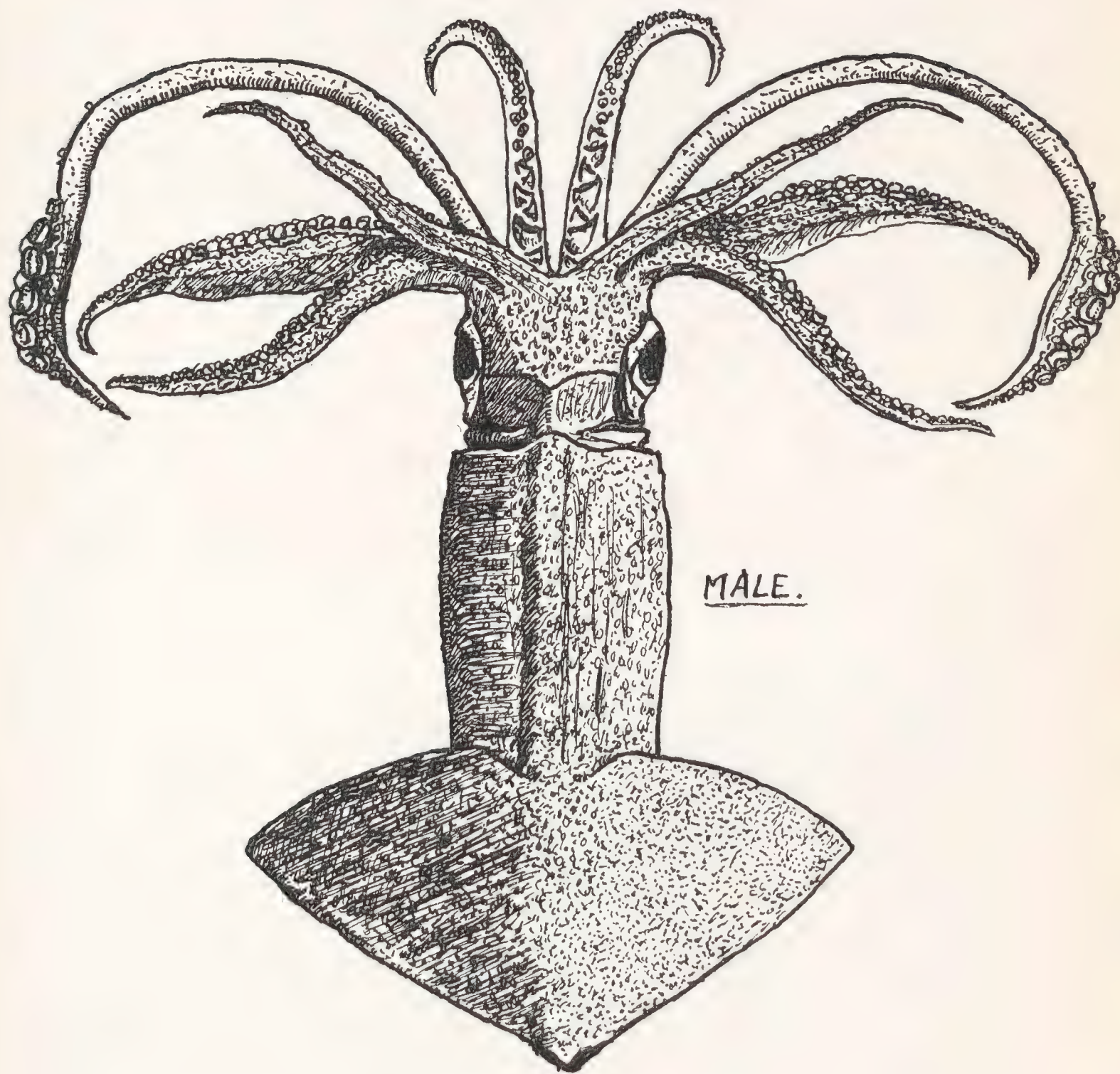
See p. 108.

[Facing p. 112.]



Ommastrephes sagittatus (Lamarck).

See p. 109.



Todaropsis eblanae (Ball).

See p. 111.

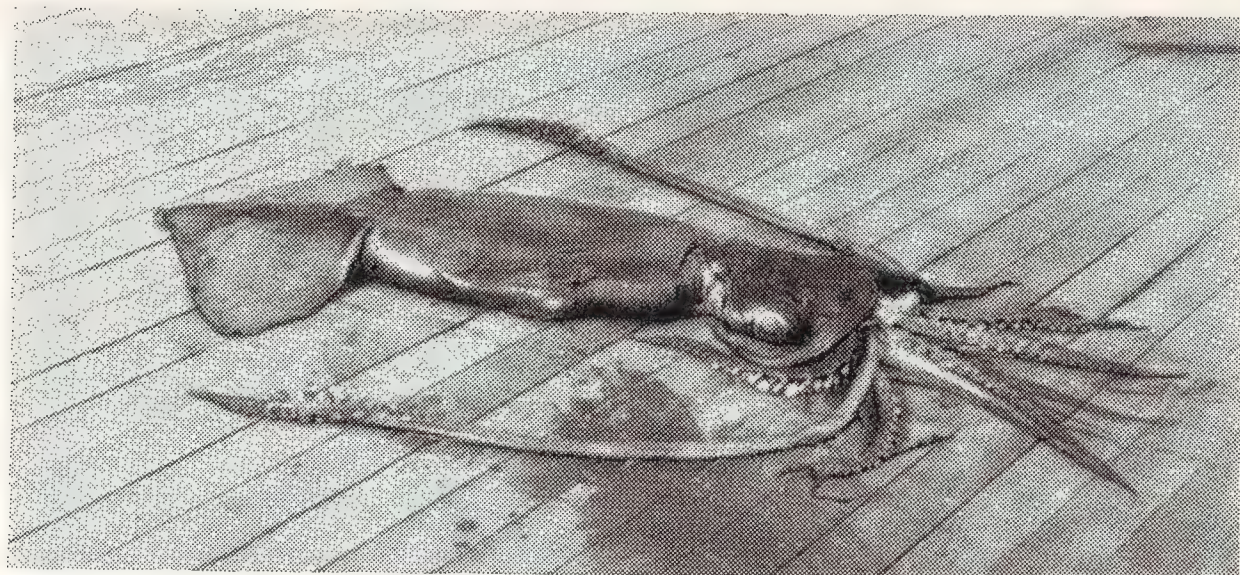


FIG. 1: *Sthenoteuthis caroli* (Furtado).
See p. 112.

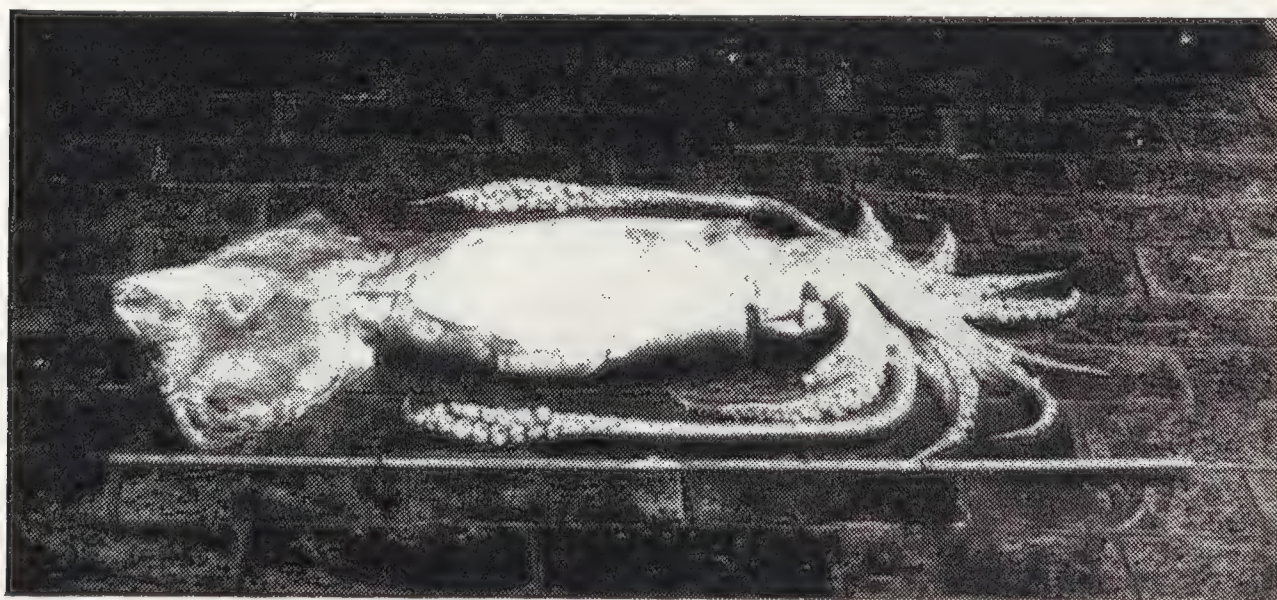


FIG. 2: *Sthenoteuthis pteropus* (Steenstrup).
See p. 114.

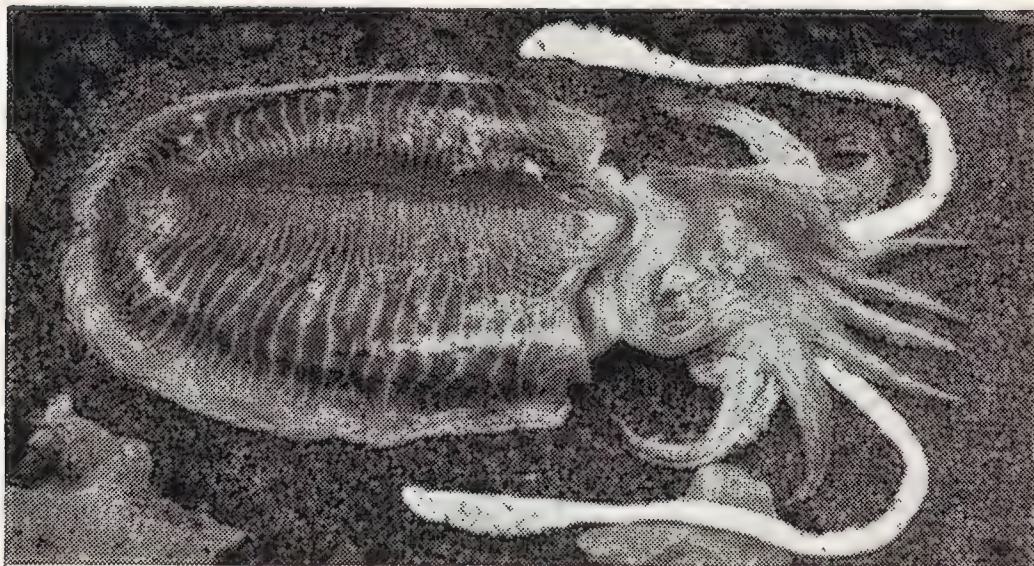


FIG. 1 : *Sepia officinalis* (Linnaeus).
See p. 103.



FIG. 2 : *Eledone cirrhosa* (Lamarck).
See p. 115.

(e) 22nd December, 1931. A specimen, "5 ft. 10 in. long, stranded alive on South Sands," Scarborough. Secured by Mr. F. D. Taylor and sent to the British Museum (Clarke, in lit.).

The above are all the definite records we have of *Sthenoteuthis caroli* in this district. From time to time, however, we hear of exceptionally large squids being found upon the shore and cut up for bait before we can examine them; these are very probably referable to this species, since of the larger forms this seems to be the most abundant on the Yorkshire coast. Mr. Clarke furnishes some interesting notes upon the occurrence of some of these large squids:—

Giant squid, unidentified, "caught on rod and line by an angler from the east pier at Scarborough on 20th May, 1929. It was measured— $4\frac{1}{2}$ feet in extreme length, and was cut up for bait. Another, about 5 feet in length, was stranded alive on the South sands in the second week in June, 1929. It was returned to the water and swam away." Again Mr. Clarke writes (13th February, 1933):—

"... Last week two more (squids) came ashore, one 6 feet over all, the other with a body, exclusive of tentacles, of 3 feet (estimated lengths), but I was not told anything about them in either case until they had been cut up, so I have no idea what species they were."

When it is considered what a small area of the coastline of Yorkshire has hitherto been investigated with regard to these strandings, it would be quite safe to assume that these giant squids are not nearly so rare as they have been thought to be.

It is probable that a careful watch in many of the secluded bays along this shore, particularly in winter-time, would yield many more records.

Remarks.—These strandings are particularly interesting for two reasons. First, they are more frequent on this part of the coast than elsewhere. A suggestion as to the reason for this is given by Robson (1929). Apparently off the Yorkshire coast the impetus of the main south-going current is coming to an end, with a consequent drop in salinity and confusion of tidal currents. It is supposed that "the immigrant *Sthenoteuthis* coming southwards with the current probably get into difficulties through lack of proper food or low salinity off the Yorkshire coast and are washed ashore where the south-going current is losing its velocity." (Robson and Clarke, 1929, p. 158.)

Secondly, with the exception of two doubtful records, all these strandings have occurred during the months of December, January, February, and March—mid-winter. This is probably to be

explained chiefly by weather conditions (squids seem to strand most frequently after sharp frosts), and also by the probability of these squids, in the course of their migrations, being off the coast at that particular time of year.

(11) *STHENOTEUTHIS PTEROPUS* (Steenstrup, 1856). PL. 6, FIG. 2.

Ommastrephes pteropus Steenstrup, 1856.

As with *S. caroli* records are not numerous. The following are all the occurrences of which we have knowledge:—

(a) 19th November, 1883. A specimen, 4 ft. 4 in. in total length stranded at Scarborough (Goodrich, E. S., 1892, *Journ. Marine Biol. Ass.*, N.S. 2, p. 314). Deposited in the British Museum.

(b) 19th December, 1907. A specimen, 5 ft. 10½ in. in total length, was stranded on the sands at Redcar. The occurrence was recorded in *The Naturalist* for December, 1908; and the article was illustrated by a photograph of another specimen of this species, stranded at Scarborough (it does not say when). The photograph is very effective, and shows the animal's front view on a board, with tentacles reaching downwards. Robson and Clarke (1929) believe these two records to refer to the same specimen.

(c) 1st March, 1912. A large, somewhat mutilated, skinless specimen was stranded on the shore at Redcliff, near Scarborough. It was received by Mr. W. J. Clarke, who photographed it, and was eventually deposited in the National Museum of Wales. Length, "not including tentacles," 3 feet.

It is noticeable that no records have occurred since 1912. What reason there may be for this, and for the fact that no specimens of *S. caroli* were recorded before 1925, can only be guessed at. Possibly these squids fluctuate in numbers over long periods of time.

Family ONYCHOTEUTHIDAE.

(12) *ARCHITEUTHUS CLARKEI* Robson, 1933.

See Robson's account in *Proc. Zool. Soc.*, September, 1933, p. 681.

One specimen, 17 ft. 5 in. in length, and weighing approximately 17 stones, was stranded in South Bay, Scarborough, on 14th January, 1933. (Clarke, in *Naturalist*, 1st July, 1933, p. 157.) Mr. W. J. Clarke, after whom this new species has been named by Mr. Robson, has supplied the writer with the following interesting account of the squid:—

"Unfortunately as it lay upon the sand it was greatly damaged by the thoughtless crowd which gathered round it. People stood upon it and peeled off nearly all the skin. One youth cut out the mandible, and another cut off the tips of both long tentacles and

took them away. After a long hunt I found the mandible in the possession of a lad about 17 years old and recovered it, but for a long time I could hear nothing about the tentacle tips, although a message was broadcast on the wireless asking for their return. But after a good deal of inquiry I heard that a certain fisherman had cut them off, taken them home, and a day or two later, when he was tired of them, they were taken to the fish-pier and dropped into one of the offal barrels. Directly I learned this I communicated with the manure works at Hull where the fish refuse goes to be converted into fertilizer, but unfortunately it was too late. Inquiries showed that a labourer handling the refuse had actually seen the tentacles, but was not interested and knew nothing of the wireless hunt for them. So they were converted into fish manure and lost. It is a great pity, for the squid was in good condition when it was first seen, with perfect skin, etc., but the assembled spectators seem to have done everything in their power to destroy it. It came ashore close to the Aquarium entrance on the foreshore, and so was easily accessible to everyone. . . . The length of the portions cut from the tentacles was estimated at 18 inches, making the full length about 19 feet. . . . ” (W. J. Clarke, in lit.)

The task of having this huge squid conveyed bodily to the British Museum was no light one, and much credit is due to Mr. Clarke for saving the specimen before it became too mutilated for identification and for seeing it safely off from Scarborough.

Sub-Order OCTOPODA.

Family OCTOPODIDAE.

(13) ELEDONE CIRRHOSA (Lamarck, 1798). PL. 7, FIG. 2.

Octopus cirrhosus Lamarck, 1798.

This cephalopod can be distinguished at a glance from the other Yorkshire species by the fact that it possesses eight sessile arms, lacking the two retractile tentacles which are characteristic of the Decapoda ; and by the fact that the suckers, which are sessile (not stalked as in decapods), are in a single row along each arm. Also, fins are lacking on the mantle.

The average size on this coast is about 1 ft. 3 in. from the end of the mantle to the tips of the longest arms. We have, however, received specimens ranging from 5 inches up to 20 inches in length.

Living specimens of *Eledone* are very beautifully and brilliantly marbled with a rich red-brown of different shades on a whitish background. The ventral surface has a distinct greenish tinge. When the animal is frightened it turns greyish-white, but if not disturbed for about 15 seconds will regain its normal red-brown

colour. (These notes were taken from a specimen that the writer kept alive once for eight hours in a tub of sea water.)

This is the only Octopus that is found here in any numbers. It is somewhat sparsely distributed over the trawling grounds, particularly of Whitby, and on the offshore ones, from 30 fathoms down. However, it does occasionally stray into shallow water, since specimens have from time to time been found stranded upon the shore; and once, Mr. Clarke tells me, an *Eledone* was seen swimming in the water in Scarborough harbour. The fishermen inform us too that this Octopus is quite often caught on their long lines.

There is some question as to the occurrence on the Yorkshire coast of the common octopus (*O. vulgaris* Lamarck, 1798). It is entered without comment in the record-book of the Scarborough Field Naturalists' Society; but since no mention of *Eledone* was made in this book, we believe that the latter has been confused with *Octopus*. Mr. Robson informs the writer that for the East coast of the British Isles north of the Straits of Dover there is only one very dubious record for *Octopus vulgaris*—from the Firth of Forth. It must certainly be very rare, if present at all, along the coast of Yorkshire. However, it may possibly occur. In April, 1928, the seining-drifter *Silver Line* took a large Octopus (estimated length 3 feet) off Whitby, and this was kept for us. Unfortunately it began to decompose before the boat reached Scarborough, and was thrown overboard. However, the fishermen stated, among other things, that each arm possessed two rows of suckers, which tallies with *Octopus*. We believe that a careful watch for this species would sooner or later yield a specimen or two.

The Author wishes to thank Mr. W. J. Clarke, of Scarborough, for his kindness in making available all his notes and records for the compilation of this report, and for the great help he has always been willing to give towards its completion; Mr. G. C. Robson, of the British Museum, for much valuable assistance concerning nomenclature, and for very kindly identifying specimens sent to the Museum; Mr. J. R. Tomlin and Mr. R. Winckworth for great help in arranging the paper for publication, and for their constructive criticism of it; and the fishermen of the various Scarborough trawlers and drifters that have been concerned in the capture of many rare forms unobtainable in any other way.

LOCALLY EXTINCT MARINE MOLLUSCA AT PORTSTEWART.

By Miss N. FISHER.

(Read before the Society, 9th December, 1933.)

THE discovery of these shells was due to Mr. R. J. Welch, who in the spring of 1931 brought me a few marine shells which he had found among the Portstewart sand-dunes, about 200 yards inland from the present beach. All the shells belonged to species which still occur on the coasts of north-eastern Ireland, except *Scrobicularia plana* (da Costa), which was represented by two perfect valves. As the presence of *Scrobicularia* needed explanation, I visited the spot several times during 1932-3. The following paper is an attempt to give the shells their rightful place in the succession of post-glacial deposits in north-eastern Ireland.

The range of sand-dunes in which the shells occur lies about $\frac{3}{4}$ mile west of Portstewart, and extends for about $1\frac{3}{8}$ miles to Ballyaghan Point, at the mouth of the Bann. The greatest width is about $\frac{1}{2}$ mile. The exact spot may easily be found, as it lies at the seaward base of the largest dune of the range, about $\frac{1}{4}$ mile from the Portstewart end. The seaward end of the small valley where the shells occur is blocked by a dune, and inland the valley broadens out, coalesces with a parallel valley, and ends at the foot of the big dune already mentioned. The shells are mixed with fine gravel and form a thin layer on the floor of the valley, thickest at the seaward end, and dwindling almost to vanishing point at the head of the valley, just before it merges into the parallel valley. Here land-shells (*Cepæa nemoralis* L.) and some kitchen-midden débris occur, but not in association with marine shells. The shells and gravel are solely on the surface; a hole dug 6 feet deep did not yield a single shell, and revealed only blown sand to the bottom. In an adjoining bowl-shaped valley were more shells and gravel, and also quantities of shell-sand trickling down the sides of the valley. No trace of any deposit from which the shells might have weathered out could be found, although the dunes were carefully searched on several occasions. Mr. Welch, who has explored the dunes many times during the last forty years, tells me that he has never seen a similar deposit there or in any other dunes. A near-by valley, about 50 yards closer to the sea, shows a storm-beach which Mr. Welch informs me is the one to which Coffey and Praeger refer (1).¹ According to their paper this beach is 6 feet above present high-water level, and I am indebted to Dr. J. W. Jackson for the

¹ The numbers in parentheses refer to Bibliography at end of article.

information that the present position of the shells is also about 6 feet above high-water level to-day.

According to (2), p. 35, and (3), pl. facing p. 384, the Portstewart dunes rest on a raised beach platform, and one especially deeply-cut valley is floored with very coarse, much-worn gravel, which may perhaps be the top of the raised beach. This gravel-accumulation, however, closely resembles the storm-beach. Coffey and Praeger (1), p. 191, state that the raised beach may be seen underlying the newer accumulation of the sandhills between the Bann sandhills and the town of Portstewart, but I believe that it is not now visible, owing to building operations. The Memoir (2), p. 35, also states that "blue shelly silt [Estuarine Clay] has been dug up in different places in the vicinity, on both sides of the river [Bann]". This seems to show that part, at least, of the Portstewart dunes is underlaid by Estuarine Clay, but it is nowhere visible. Praeger (4), p. 224, has described a typical *Scrobicularia* deposit overlaid by 6 feet of blown sand, at the eastern end of the Castlerock dunes, on the other side of the Bann.

The storms of the winter 1932-3 revealed a fine kitchen-midden in the valley parallel to that in which the shells were first found. The following species of mollusca were noted from this deposit: *Patella vulgata* L., *Littorina littorea* (L.), *Glycymeris glycymeris* (L.), *Ostrea edulis* L., *Pecten maximus* (L.).

In the following list I have for comparison marked with an asterisk those species which now occur in the district, taking Fair Head and Lough Foyle as the boundaries. Lack of information has prevented me from distinguishing those species which actually *live* in the district at the present time, and those which are only represented by dead shells. Any notes on the present range of a species refer *only* to its occurrence in this area, except where a larger area, such as north-eastern Ireland, is specifically mentioned.

The marine molluscan fauna of this district has been investigated by Chaster (6, 7) (Ballycastle and Rathlin Island), Knight (8) (Portstewart), Galwey (9) (Magilligan), and Jeffreys (10) (Lough Foyle). The nomenclature and arrangement throughout are those of Winckworth's "The British Marine Mollusca" (5).

**Diodora apertura* (Mont.). Frequent.

**Patella vulgata* L. Not common, mostly small.

**Patella athletica* Bean. Four.

**Patina lævis* (Pennant). About a dozen.

**Patelloida virginea* (Müller). Frequent.

**Calliostoma zizyphinum conuloide* (Lam.). One small imperfect specimen.

- Calliostoma papillosum* (da Costa). One very young specimen is referred by Mr. Winckworth to this species. Very rare in north-eastern Ireland at present.
- **Gibbula cineraria* (L.). Rather scarce.
- **Tricolia pullus pictus* (da Costa). Also rather scarce.
- **Lacuna parva* (da Costa). Two small specimens.
- [**Littorina littorea* (L.). Many broken specimens, which I think are from a kitchen-midden deposit. Also a few perfect specimens, which may be contemporary with the other shells.]
- **Littorina saxatilis* (Olivi). Scarce.
- **Littorina neritoides petræa* (Mont.). One, small.
- **Littorina littoralis* (L.). Scarce, only a few small specimens.
- **Hydrobia ulvæ* Pennant. Very plentiful; the predominant species in the shellsand.
- **Cingula semicostata* (Mont.). Very plentiful, and, after *Hydrobia ulvæ*, the most abundant species in the shellsand.
- **Alvania crassa* (Kanmacher). Moderately common.
- **Alvania punctura* (Mont.). Fairly frequent.
- **Rissoa parva* (da Costa). Plentiful.
- **Tornus subcarinatus* (Mont.). Three perfect specimens. The occurrence of this distinctive species is interesting for, though odd shells turn up occasionally on the coasts of north-eastern Ireland, it has not been taken alive. The only "live" Britannic records are from the south of England. *Tornus* is entirely southern in its extra-British range, finding its northern limit of range in the British Isles.
- **Skeneopsis planorbis* (Fab.). Few.
- **Turritella communis* Risso. One 2 inches long, and a small worn one.
- **Bittium reticulatum* (da Costa). One.
- **Cerithiopsis tubercularis* (Mont.). Ten, the short obese form.
- Cerithiopsis barleei* Jeffreys. Seven. New to north-eastern Ireland, either as a recent or fossil species. Its extra-British range appears to be entirely southern.
- **Triphora perversa* (L.). Four.
- **Clathrus clathratulus* (Kanmacher). Several.
- **Graphis albida* (Kanmacher). Two perfect and one broken.
- **Aclis ascaris* (Turton). Five.
- **Aclis minor* (Brown). Three and a large fragment.
- **Eulima trifasciata* (J. Adams). About a score of all sizes.
- **Balcis lubrica* (Monterosato). One. Only recent north-eastern Ireland record is "Off Ballycastle, living".
- **Balcis devians* (Monterosato). Eight.
- **Chrysallida obtusa* (Brown). Several.
- **Chrysallida indistincta* (Mont.). Nine.

Chrysallida decussata (Mont.). About twenty. Referring to this species J. T. Marshall (*Journ. Conch.*, 9, p. 290) states that "usually there are only three sculptured whorls, but in fine adult specimens there is a fourth". More than half of the Portstewart specimens have four sculptured whorls and one especially fine example has five. *C. decussata* is new to north-eastern Ireland either as a contemporary or fossil species. Its extra-British distribution appears to be entirely southern.

**Chrysallida spiralis* (Mont.). Plentiful.

**Menestho divisa* (J. Adams). One.

Menestho diaphana (Jeff.). Four. New to north-eastern Ireland, either recent or fossil. Its present range is "Bergen to Eastern Medn. and Adriatic" (Jeffreys, *P.Z.S.*, 1884, p. 349).

**Odostomia acuta* Jeff. Nine.

**Odostomia scalaris* (MacGillivray). Three.

**Eulimella lævis* (Brown). Three perfect and a broken one.

**Turbonilla elegantissima* (Mont.). Four immature.

**Turbonilla acuta* (Donovan). One.

**Turbonilla fulvocincta* (Thompson). One immature.

**Aporrhais pespelicani quadrifidus* da Costa. One, and three large fragments.

**Natica poliana alderi* Forbes. Two small worn specimens.

**Trivia monacha* (da Costa). One.

**Trivia arctica* (Mont.). One, and several fragments.

**Nucella lapillus* (L.). Moderately common, but small.

**Ocenebra erinacea* (L.). Few.

[**Buccinum undatum* L. Many fragments, but not a single shell.

These fragments are puzzling; they do not appear to be of the same age as the other shells, but look as if they had come from a kitchen-midden deposit, yet not even a fragment was noted in the kitchen-midden in the parallel valley. Only a few minutes, however, were devoted to the examination of the latter deposit, so it is quite possible that *Buccinum* does occur there and was overlooked.]

**Nassarius reticulatus* (L.). Three, and a large fragment.

**Nassarius incrassatus* (Ström). One.

**Philbertia linearis* (Mont.). Four small specimens.

**Mangelia coarctata* (Forbes). Three small specimens.

**Retusa mammillata* (Phil.). Three.

**Retusa retusa* (Maton & Rackett). Frequent.

**Cylichna cylindracea* (Pennant). One imperfect.

**Nucula nucleus* (L.). Plentiful.

**Glycymeris glycymeris* (L.). Small valves abundant.

**Arca tetragona britannica* Reeve. Two small valves.

- **Anomia ephippium* L. Small valves fairly plentiful.
- **Mytilus edulis* L. In the first valley examined only a few small valves were found, but in the second valley (that in which the shellsand was found) large valves were not infrequent.
- **Musculus marmoratus* (Forbes). Two valves.
- **Ostrea edulis* L. Rare and mostly small ; larger valves very thin.
- **Pecten maximus* (L.). One small valve.
- **Chlamys varia varia* (L.). Many but much scarcer than *C. opercularis*.
- **Chlamys distorta* (da Costa). Plentiful.
- **Chlamys opercularis* (L.). Plentiful.
- **Chlamys tigerina tigerina* (Müller). Five valves.
- **Chlamys tigerina obsoleta* Pennant. Plentiful, far outnumbering the type-form.
- **Phacoides borealis* (L.). Valves plentiful, of all sizes.
- **Kellia suborbicularis* (Mont.). Two.
- **Lasæa rubra* (Mont.). Plentiful.
- **Turtonia minuta* (Fab.). Plentiful.
- **Lepton nitidum* Turton. Three.
- **Montacuta ferruginosa* (Mont.). Few valves.
- **Mysella bidentata* (Mont.). Plentiful.
- **Cyprina islandica* (L.). Very plentiful, of all sizes. Also one half-grown specimen with the valves still together—the only specimen of any species found in this condition. It appears to be the only species among the Portstewart shells whose extra-British range is essentially northern.
- **Cardium echinatum* L. Three young and one half-grown.
- **Cardium scabrum* Phil. Plentiful.
- **Cardium exiguum* Gm. Several.
- **Cardium ovale* Sowerby. Plentiful.
- **Cardium edule edule* L. Fairly common.
- **Dosinia lupinus lincta* (Mont.). Two large valves, and several small ones.
- **Gafrarium minimum* (Mont.). Few valves.
- **Venus casina* L. One very large old valve, one adult, and two small.
- **Venus ovata* (Pennant). Frequent.
- **Venus fasciata* (da Costa). Fairly common, but not so abundant as those of *V. striatula*.
- **Venus striatula* (da Costa). Plentiful.
- **Paphia rhomboides* (Pennant). Several, large and small.
- **Paphia pullastra* (Mont.). Several, of all sizes.
- **Paphia saxatilis* (Fleuriau). One valve.
- Paphia decussata fusca* (Gm.). Four. Extremely rare at the present time in north-eastern Ireland. “Portrush, a specimen with the

valves united, but old and worn-looking" (Praeger (13), p. 72) is the only record from the district, where it is now extinct. It is an abundant and characteristic fossil of the Lower Estuarine Clay throughout north-eastern Ireland.

**Donax vittatus* (da Costa). Abundant of all sizes.

**Tellina fabula* Gm. Several.

Tellina donacina L. One large and two small. A rare species in north-eastern Ireland.

**Tellina pygmæa* Lovén. Two.

**Tellina crassa* Pennant. Four large and two small.

**Macoma balthica* (L.). Plentiful.

Scrobicularia plana (da Costa). Plentiful. Now extinct in north-eastern Ireland (see Praeger (4), p. 254), though it occurs in vast numbers in the Lower Estuarine Clay.

**Abra prismatica* (Mont.). Few.

**Gari fervensis* Gm. Plentiful.

**Gari tellinella* (Lam.). Two large and several small.

**Cultellus pellucidus* (Pennant). Several broken valves and fragments.

**Ensis ensis* (L.). Several fragments.

**Macra corallina cinerea* Mont. Few.

**Spisula elliptica* (Brown). Few.

**Spisula solida* (L.). Fairly plentiful.

**Spisula subtruncata* (da Costa). Plentiful.

**Aloidis gibba* (Olivi). Few.

**Hiatella arctica* (L.). Four.

**Hiatella gallicana* (Lam.). Many, much more plentiful than *H. arctica*.

Pholas dactylus L. Two fragments.

**Thracia villosiuscula* (MacGillivray). Three valves.

The absence of both *Mya* and *Lutraria* is noticeable. It is of interest to analyse the geographical distribution of the shells enumerated above (excluding *Buccinum* and *Littorina littorea* as of doubtful origin). At the present time and as far as is at present known, of the 113 species recorded, fourteen species reach their northern limit of range in the British Isles, and two of these do not now live in north-eastern Ireland (*Chrysallida decussata* and *Cerithiopsis barleei*). One species (*Cyprina islandica*) almost reaches its southern limit of range in the British Isles. It occurs in north-western France but is very rare. Ninety-eight species range both north and south of the British Isles.

As the shells are obviously not in situ it is difficult to assign them to their proper place in geological history, but a careful study brings out some interesting points, and enables them to be dated with

a reasonable show of accuracy. It has been suggested that the shells were merely blown wind-borne from the present beach, and are therefore contemporary, and of no special interest, but several facts are against this theory. Firstly, the abundance of *Scrobicularia plana*, a species now extinct in north-eastern Ireland, and the presence also of *Paphia decussata*, which is extremely rare (see Fisher, (11)). Secondly, when the dunes were visited in October, 1932, by Professor J. K. Charlesworth, Dr. R. Ll. Praeger, Mr. R. J. Welch, and myself, a gale was blowing and it was impossible to face the sand-laden blast, yet, as Dr. Praeger pointed out to us, the sand was being blown away from beneath the shells, so that they were gradually sinking; the shells themselves were not being blown about at all. In view of these facts the theory does not seem tenable.

Considered as a whole, the fauna resembles that of the Estuarine Clay, but when examined in detail it differs in several important particulars. The Estuarine Clay fauna indicates a fairly definite depth of water in which the deposit was laid down, but the Portstewart shells comprise both littoral species and those that live in deeper water, showing that the mollusks could not have lived and died on the spot where they are now found, but have been brought together by some other agency.

It is true that the Portstewart shells include both *Scrobicularia plana* and *Paphia decussata*, characteristic fossils of the Lower Estuarine Clay, which is known to occur in the neighbourhood, but they also comprise more recent "immigrants", the most striking examples being *Rissoa parva* and *Cyprina islandica*. Of *Rissoa parva*, so common everywhere at present, Praeger (4), p. 260, says: "Compared with its present abundance on our shore, this species is conspicuously rare in the Estuarine Clays." There its place is taken by the allied *R. albella*, now practically extinct in Ireland, save in the south and west. *R. albella* is absent from the Portstewart shells where *R. parva* is abundant. *Cyprina islandica* is also "conspicuously absent from the estuarine series" (Praeger (4), p. 251), yet it is plentiful and of all sizes in the Portstewart shells, as on our coasts at the present time.

Mr. A. W. Stelfox has suggested, and my own researches fully bear him out, that the shells belong to a period later than that of the Neolithic ("25 foot") Raised Beach. His theory is that the elevation of the land which brought the Raised Beach gravels to their present position also raised the Estuarine Clay sufficiently to allow of its being eroded by wave-action. The shells washed out of the Estuarine Clay together with those of other species then living in the vicinity were re-deposited as a beach-deposit. This deposit was then perhaps overlaid by blown sand, from which the

shells are now weathering out. Mr. Stelfox's theory, I think, fully explains the association of *Scrobicularia* and *Paphia decussata* with *Cyprina* and *Rissoa parva*, the two former species being re-deposited and the two latter representative of the fauna living at the time this beach-deposit was accumulating. Further evidence that the shells form part of an old beach-deposit is afforded by the curious mixture, which has already been noted, of littoral species with those from deeper water, and also the fact that the Lamellibranchs are all represented by single valves only. The Gastropods also are all more or less worn.

The following twenty-eight species occurring among the Portstewart shells are not mentioned by Praeger (4) in his list of the Estuarine Clay fauna of north-eastern Ireland, in which all earlier records are included.

Calliostoma zizyphinum conuloide (Lam.), *Calliostoma papillosum* (da C.), *Tornus subcarinatus* (Mont.), *Cerithiopsis tubercularis* (Mont.), *Cerithiopsis barleei* Jeff., *Triphora perversa* (L.), *Clathrus clathratulus* (Kanmacher), *Graphis albida* (Kanmacher), *Balcis lubrica* (Monterosato), *Balcis devians* (Monterosato), *Chrysallida decussata* (Mont.), *Chrysallida spiralis* (Mont.), *Menestho diaphana* (Jeff.), *Turbonilla fulvocincta* (Thompson), *Nassarius incrassatus* (Ström), *Philbertia linearis* (Mont.), *Arca tetragona britannica* Reeve, *Chlamys tigerina* (Müller), *Cardium ovale* Sow., *Gafrarium minimum* (Mont.), *Paphia saxatilis* (Fleuriau), *Donax vittatus* (da Costa), *Tellina donacina* L., *Tellina pygmæa* Lovén, *Tellina crassa* Pennant, *Abra prismatica* (Mont.), *Gari tellinella* (Lam.), *Macra corallina cinerea* Mont. Most of these species undoubtedly belong to the later "immigrant" fauna rather than to that of the Estuarine Clay.

Praeger (12), p. 30, has described a deposit at the Alexandra Dock, Belfast, which appears similar to that from which the Portstewart shells were derived. This deposit consisted of "Two feet of coarse yellow sand, with abundance of shells. . . . The shells are often much worn, and generally occur as single valves, and the deposit has all the appearance of an old sandy beach." It was overlaid by 6-7 feet of black littoral clays, and rested directly upon the Estuarine Clay, the line of demarcation being remarkably sharp and well defined. The fauna of this Belfast bed is not listed separately, but on p. 30 and in the annotated list of species (pp. 38-44) thirty-six species are mentioned as occurring in the "yellow sand". Twelve of these species do not occur at Portstewart, but of the 113 species known from the latter deposit eighty-nine are not recorded from the Belfast bed. In this Belfast bed many species make their first appearance as

members of our present fauna. In this connection it is interesting to note the apparent briefness of the period during which *Chrysallida decussata*, a southern shell, lived in north-eastern Ireland. It is unknown in the Estuarine Clays and Raised Beaches, occurs in some numbers among the Portstewart shells, the specimens being unusually fine, and is now apparently extinct.¹

The Portstewart assemblage, therefore, represents a beach-deposit, in age younger than the Estuarine Clay, and containing some shells derived from the Lower (*Scrobicularia*) zone of the Clay.² The fauna closely approximates to that of the present time, but a slightly warmer climate is suggested by the presence of *Chrysallida decussata*, and also by the absence of many common species whose present range is mainly or wholly northern. There is evidence of a degeneration of the climate since the deposition of the Estuarine Clays; this degeneration is shown by the appearance in abundance of *Cyprina islandica*, a species whose present headquarters are the Icelandic coasts.

I wish to express my gratitude to Mr. R. MacDonald and Mr. R. J. Welch for help with the field work; to Mr. R. Winckworth for checking the identifications of all the smaller shells; and to Mr. A. W. Stelfox without whose help, so generously given, this paper would not have been written.

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¹ The Turbot Bank records (specimens marked "Co. Antrim" in Belfast Museum are almost certainly from the Turbot Bank) given by Nichols (14), p. 552, are not contemporary—probably early post-glacial.

² The Upper (*Thracia*) zone of the Estuarine Clay does not appear to be present in the Bann deposits (see Praeger (4), pp. 215 and 223-4). None of its characteristic fossils is represented in the Portstewart shells.

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Self-fertilization.—In March, 1931, Mr. Charles Oldham kindly sent me some specimens of *Planorbis corneus* var. *albina* (Moq.). These were kept by me in rectangular glass tanks and from the young produced in the summer of 1931 one was isolated from the time of hatching in a tank 8 inches by 5 inches, in water some 6 inches deep. The tank has about 3 inches of sand, in which various water plants grow, the whole forming a fairly well balanced aquarium. In 1932 this snail produced a small egg-capsule which contained two eggs; it is not known whether these were fertile or not but they failed to hatch. In 1933 the same snail produced three egg-capsules from which five young snails were hatched; they were apparently perfectly formed and when examined under a lens seemed quite normal, but all died within a few weeks. This summer, 1934, three batches of eggs have been laid by the snail. From the first capsule deposited two snails emerged, and these are, at the time of writing (October), 1.7 cm. and 1.4 cm. in diameter. From the second capsule five snails hatched, two of which died within a week, the other three are now 5 mm. in diameter, in both cases two eggs remain unhatched in the capsules. The third batch of eggs so far has not hatched and appears to be sterile. Of the five surviving snails, one has been isolated from birth with a view to obtaining evidence as to whether self-fertilization will take place in a second generation. The other four are being kept together to see if these creatures are sexually perfect.—CHARLES ALLEN. (*Read before the Society, 11th November, 1934.*)

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CONTENTS.

	PAGE
Yorkshire Cephalopods—W. J. CLARKE and J. A. STEVENSON .	129
Mollusca of the Sheep Ponds on the Eastbourne Downs— G. SHRUBSOLE .	130
<i>Vertigo genesii</i> Gredler in Central Ireland—R. A. PHILLIPS .	142
<i>Testacella</i> in Sussex—J. R. LE B. TOMLIN .	145
Notes on the Snails of the Mullet, W. Mayo—C. OLDHAM .	146
<i>Testacella</i> eating <i>Milax</i> —A. G. STUBBS .	149
The Dates of Publication of Forbes and Hanley's <i>Hist. Brit.</i> <i>Moll.</i> —N. FISHER and J. R. LE B. TOMLIN .	150
Flood-débris in Poland—A. JANKOWSKI .	152
Editorial Notes .	154
Proceedings: 13th Oct. (cont. from p. 96), 10th Nov., 8th Dec., 1934; 12th Jan., 9th Feb., 9th March, 6th Apr., 11th May, 1935 .	155

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YORKSHIRE CEPHALOPODS.

By W. J. CLARKE, F.Z.S., and J. A. STEVENSON.

WHILE a recent paper in this *Journal*¹ upon the Cephalopods of the Yorkshire Coast by the junior author was in the press, three additional records were made which should be mentioned to complete the series already published. They are as follows:—

Sthenoteuthis caroli (Furtado).

(a) 31st January, 1935. A specimen stranded on the sands at South Bay, Scarborough, and discovered by Mr. A. Audibert and Dr. N. Walsh. Length: "... 5 feet from the tip of the longest tentacle to the tip of the tail . . ."; width of fins, 20 inches. Deposited in the Hull Museum. (Clarke.)

(b) 13th February, 1935. A specimen stranded on the shore about $1\frac{1}{2}$ miles north of Scarborough. Length: 5 ft. 2 in. over all. This specimen was brought by Mr. C. B. Horsman and Mr. Rhodes Wilson to the Scarborough Museum, where it is being preserved.

Ommastrephes sagittatus (Lamarck).

23rd March, 1935. A specimen, $37\frac{1}{2}$ inches in total length, was stranded on North Sands, Scarborough, and examined by the senior author. Specimen not preserved.

¹ *Journ. of Conchol.*, vol. 20, p. 102.

MOLLUSCA OF THE SHEEP PONDS ON THE EASTBOURNE DOWNS.

By GEORGE SHRUBSOLE.

(Read before the Society, 10th Nov., 1934.)

THE Downs included in this district are those within a 7 miles radius from Eastbourne. They begin at Beachy Head and the River Cuckmere forms the western boundary, though a small part of the Downs across the river comes within the district.

It is probably true to say that there are no natural ponds on the Downs. Without some artificial assistance, such as puddled clay, the ground will not hold water. Scattered over the Downs is a number of ponds used for watering sheep—sheep ponds, popularly known as dew ponds.

Originally these ponds were constructed in various ways. After excavating a bed was made with chalk, clay, sand, flints, and straw, according to the maker's method. The puddled clay rendered it watertight. The ponds were circular in shape with sloping sides. Some of these ponds must have been in existence as long as sheep have been grazed on the Downs. Others no doubt were added at times when the price of wool caused more land to be grazed, going out of use or derelict when the industry fell off. Puddled ponds, however, are liable to damage from the feet of cattle and sheep using them, and in time the bed would leak. The life of a puddled pond may have been about forty years. There have probably been, therefore, several remakings of the older ponds on the same sites. In more recent years the puddled ponds have been replaced by ponds wholly of cement, with wide cemented margins. There is only one puddled pond, in very bad condition, remaining on these Downs to-day. The present cemented ponds show signs of age, and advantage was taken of the lowness of the water in 1933 and 1934 to repair thirteen ponds; two others have been done recently, probably in 1933. At least four more need attention. A cemented pond should have a longer lease of life than a puddled one, but these ponds give the impression that insufficient cement was used on the sides. With a cracked or broken margin (liable to increase through frost) a pond does not collect a full supply of water in the winter, and so starts the summer short of water and becomes foul. These ponds depend almost entirely upon rainfall for their water supply. Rainfall is greater on the high Downs than in the lower surrounding country, and their wide cement margins increase the catchment area very considerably. A pond 70 feet across has an area of about

20 yards square, and at every rainfall the rain over this area is collected in the basin of the pond.

Usually these ponds get no land drainage, partly from their situation, sometimes on the highest bit of ground locally, and partly because the excavated material forms a mound round the pond. In the case of one or two ponds, however, the bank has been cut and a cemented drain brings in drainage from suitable higher collecting ground, such as a hard track. Recently three ponds lying alongside the road have had road drainage turned into them. Receiving no land drainage these cemented ponds are normally free from mud. A little slime on the sides under water, often greenish from algæ, is all that is seen. In the centre of the pond, however, a black deposit gathers, probably the work of many years, the result of decayed vegetation, grass, and, if there are trees near, leaves, and possibly dead water-weed, but "deposit" ponds usually contain little weed, perhaps *Zannichellia*, or a *Potamogeton* of a similar type (linear leaves). There is no body to the deposit; a dredger full of it dipped in the water clears at once, practically no residue remains, except a few grass stems, etc., not yet fully decayed. The quantity of the deposit varies, apart from the age of the pond. Around ponds where there is now no grazing the grass grows long with many plants. This growth dies down and the dead material is blown into the pond. The accumulation of deposit is greatest where the pond is situated in a hollow. If cattle have access to a pond the deposit is largely increased with the insoluble portion of the manure.

There is usually an abundance of insect life, gnat larvæ, water beetles, etc., in these ponds, and in several cases newts occur.

Besides the sheep ponds proper there is another kind of pond found on the Downs, the old farm ponds, occurring close to farm buildings. They are puddled ponds, generally in poor condition, verging on derelict, whilst one has been converted into a cement pond.

Previous to this survey in 1934 very little conchological work had been done on these ponds. Six of the more easily accessible had been known for some years to contain *Limnæa pereger*; dredging produced little more. Early in 1934 a pond was brought to notice, hitherto unknown, and the discovery in it of several species, scarcely expected in such a situation, led to a re-examination of the ponds previously visited, with the result that a survey of all the ponds on the Downs was decided on.

The drought in 1933, continued in 1934, though it spoilt some ponds through cleaning operations, presented a most favourable opportunity for the examination of their deposits. When the ponds

are well filled it is practically impossible even with a long-handled dredge to reach the deposit in many ponds.

An explanation of the term "cleaned" as applied later to some of the ponds is necessary. Owing to the drought in 1933 advantage was taken of the lowness of the water to clean a number of ponds. This was not primarily to get rid of any deposit present, but to allow of repairs to the cement work. The pond was emptied of water and the deposit thrown out, and the necessary repairs made. The pond was left to fill with rain, unless it happened to serve a farm.

This process if thoroughly carried out would destroy any mollusca present, but it seems probable that in some cases it could be ascertained that the cement in the centre of the pond was sound (the usual defects are cracks in the margin running down into the pond), without entirely emptying it or removing all the deposit.

Some such explanation appears to be necessary to account for the fact that though none of these "cleaned" ponds showed any mollusca in May, 1934, some young *L. pereger* appeared later in the year in several of them. It is also probable that some ponds after cleaning stood longer than others waiting for rain, and may even have gone dry.

Unfortunately some of these ponds had not been visited before cleaning, and it cannot be ascertained now if they used to hold mollusca. Such of them therefore as show no signs of snails now are omitted when drawing any conclusions from the list.

The man who carried out the work on most of the ponds has left the district, and no one has been met with who knows exactly what happened at each pond.

The heights of the ponds are taken from the Ordnance Map, when given, in other cases from the contours. A pond's elevation is not a guide to its isolation. To reach a pond in a valley it may be necessary to cross ground over 400 feet high.

Mr. Charles Oldham very kindly named the Pisidia for this survey, and Mr. T. J. Richards, of Eastbourne, the pond weeds.

NOTES ON THE PONDS.

(1) *Pashley*.—Held *L. pereger* up to cleaning in 1933. Deposit; probably vegetable and small, but difficult to reach. No weeds. In some six visits during the year only two young *L. pereger* were seen, 5th July, 1934.

(2) *Beachy Head Road. I*.—Held *L. pereger* up to cleaning in 1933. Deposit; now receives road drainage. Difficult to dredge.

No weeds. *L. pereger* (young) found on 8th August and subsequently. 1934.

L. pereger plentiful. 1935.

(3) *Beachy Head Road. II.*—Exactly the same as Pond (2).

(4) *Black Robin Bottom.*—Derelict; only mud, manure, and rubbish in centre, with a little rain water. May, 1934.

Cement had been repaired and possibly some mud removed. Full of water, but still muddy. March, 1935.

(5) *East Hale Bottom.*—Thick deposit, largely cow manure. No weeds; newts numerous. *L. pereger* abundant. May, 1934.

Cement had been repaired and pond cleaned out. Scarcely any deposit. No signs of *L. pereger*. March, 1935.

(6) *Wigden's Bottom.*—Not known previous to cleaning in 1933. But little deposit and no signs of molluscs. May, 1934, and March, 1935.

(7) *South of Polo Ground.*—Derelict; mud, manure, and rubbish in centre with a little rain-water. Would be dry later. No signs of mollusca. May, 1934.

Half filled with water (winter rain); very foul. March, 1935.

(8) *Bullock Down Farm.*—Not known previous to cleaning in 1933. No snails or weed. April, 1934. A lot of chalky mud has been brought in by drain, March, 1935.

(9) *Bullock Down. I.* Not visited previous to cleaning in 1933. No weed or snails. April, 1934.

Slight deposit, little weed just showing. Full of *L. pereger* (young). March, 1935.

(10) *Bullock Down. II.*—Not visited previous to cleaning in 1933. No snails or weed. April, 1934.

Very little deposit, no snails. March, 1935.

(11) *Belle Tout.*—Not visited previous to cleaning in 1933. No deposit or snails, several visits. 1934.

Slight deposit, confervæ, and some weed just showing. No snails. March, 1935.

(12) *Crow Link.*—Cement in very bad condition, large patches missing, pond cannot fill within 10 feet of margin, consequently starts the summer short of water. Water very low and foul by July. Very heavy vegetable deposit. Thick bed of *Chara fragilis*, some *Ranunculus aquatilis*, duckweed, and Confervæ. Dredged several times, no sign of any mollusca. 1934.

Pond 12 feet below margin, less than 2 feet of water above deposit. Full of Confervæ. No mollusca. 27th March, 1935.

(13) *Pea Down*.—Not visited before, but looks as if it had been cleaned. No deposit within reach, some slime and cow manure, water coloured by it apparently. No weeds and no signs of snails. July, 1934.

Pond heavily charged with manure and margin covered with it. This must wash into pond. No weed or snails. 1st April, 1935.

It seems likely that ponds used by large herds of cattle must be cleaned or raked out at no long intervals. This pond may have been cleaned in 1933, and may require it again at the end of this summer. Some ponds are wired off from cattle.

Regular cleaning might eliminate snails if present or prevent them establishing themselves.

(14) *Down's Golf*.—Fairly thick deposit with some mud, a cemented drain brings in drainage water. Water rather low. A few small patches of *Zannichellia palustris*.

S. lacustre plentiful. 10th July, 1934, and 26th March, 1935.

Thick deposit. No weed, well filled with water.

(15) *Hill Cottages*.—Margin of pond showed some repairs had taken place, probably in 1933. Well filled with water, thick vegetable deposit in centre. A little weed. *Potamogeton pectinatus*. Two living *L. pereger* and three dead shells; one dead newt. A careful search revealed nothing more. The pond had probably not been cleaned out, but in repairing the margin when the water was low some lime may have killed off the stock of snails. July, 1934.

Pond well filled. One large *L. pereger* and a number of young. 26th March, 1935.

(16) *Willingdon Golf*.—Thick deposit. Only a few inches of foul water. Would be dry last year and probably again this. No weed or signs of snails. 10th July, 1934. Fair supply of water, but cement margin faulty. 13th April, 1935.

(17) *Oxendean*.—Not visited previous to cleaning in 1933. Vegetable deposit, but a drain brings in some mud. No signs of any mollusca in April. The pond got very low by October; the farm pond having failed, water was taken for farm purposes. It was possible to dredge all the deposit and some *S. lacustre* were found. 1934.

Pond rather full. No weeds, some Confervæ. It was only possible to reach the edge of the deposit, but one *S. lacustre* was found. March, 1935.

(18) *Bourne Hill*.—Small deposit, but cemented drain brings in land drainage. No weeds. *S. lacustre* in fair numbers. A few dead adults, the living half-grown. 4th June, 1934.

Upper cement work poor condition. Only half-full. *S. lacustre*. 12th April, 1935.

(19) *Ratton Park*.—Very heavy deposit, chiefly leaves and manure. Much *Confervæ* and *Ranunculus aquatilis* in patches. *L. stagnalis* most plentiful, and newts. May, 1934, and March, 1935. Not much water. Heavy deposit, many leaves. Much *Confervæ* and weed just showing.

(19a) *Ratton Park*.—Derelict. Only some rain-water in pond, which must have been dry 1933-4. March, 1935.

(20) *Ratton (Willingdon)*.—Cement of margin broken in places. Heavy deposit with manure and leaves. A little *Ranunculus aquatilis* and *Confervæ*. No trace of snails. May and June, 1934. Water low. No snails. April, 1935.

(21) *Hanging Hill*.—Top 15 feet of margin has been recoated with cement, probably 1933. Heavy deposit leaves and manure. A little weed, *Zannichellia palustris* and *Ranunculus aquatilis*. No sign of snails or bivalves. 4th June, 1934. Pond rather full. Difficulty in reaching deposit. A lot of dredging produced six *S. lacustre* (two dead). No signs of *L. pereger*, which was seen in this pond some years ago ; the cementing may have killed them. March, 1935.

(22) *Water Works Drive*.—Derelict, cement faulty. In wet weather it holds about a foot of water. Dry in 1933 and 1934. At times there are newts. May, 1934.

Only a little water in centre of pond. March, 1935.

(23) *Middle Brow*.—Cement margin in bad condition, but the basin appears quite sound. Deposit, vegetable, but difficult to reach. Algæ and slime on the sides. *L. pereger* numerous. 17th May, 1934.

Pond fairly full, water greenish. No *L. pereger* could be seen, but dredging produced some young snails. A wild duck was on the pond, and this may account for no snails being visible. 2nd April, 1935.

(24) *Long Man*.—A rectangular pond with rounded ends and steep sides. Known to have held *L. pereger* for some years. Considerable vegetable deposit. Some slime on sides. A little *Potamogeton pusillus*. *L. pereger* but no bivalves. May, 1934.

(25) *High and Over*.—A rectangular pond with rounded ends and exceptionally steep sides. Has held *L. pereger* for some years. Noticing that mud (excavated earth) had accumulated at the lower end, the pond was carefully dredged. *L. pereger* numerous and *Pisidium casertanum* and *P. nitidum* occurred freely in the mud. April, 1932.

Later the road past the pond was widened and much earth got in along the whole length. Road drainage was also turned into the pond.

In May, 1934, a thick bed of *Potamogeton lucens* covered the mud, with a few patches of *Ranunculus aquatilis* and later *Chara fragilis*.

Dredging produced in addition to *L. pereger*, *P. casertanum* and *P. nitidum*, and for the first time *S. lacustre*. Two further visits in May and July produced the same result. 1934.

(31) *Snap Hill*.—Cement in very bad condition. Dry in 1933 and 1934.

Pond had been dry but recent rain had just covered the deposit; vegetable with a little mud. Dead weed, too rotten to identify, covered the deposit. The latter was too hard to dredge but six dead (adult) *S. lacustre* were lying on it. 28th July, 1934.

Water only 10–12 feet across. *Ranunculus aquatilis* fairly thick. Thorough dredging produced one dead *S. lacustre* and one living (young). Should pond dry again, as is most probable with so little water, *S. lacustre* can scarcely survive. 2nd April, 1935.

(32) *Charlston Bottom*.—Derelict and dry. July, 1934.

(26) *East Dean Road*.—The only puddled sheep pond which has not been cemented. In poor condition, gets very low but not quite dry. *Ranunculus aquatilis* plentiful, with *Zannichellia palustris* and Confervæ. Some *Alisma plantago*. *Glyceria fluitans* all round the sides. *L. pereger* plentiful, with *P. crista*, *S. lacustre*, and *P. milium*. May, 1934.

(27) *Peakdean*.—A derelict farm pond; mud and manure with some rain water in the hollows. No sign of mollusca. 28th May, 1934.

(28) *Friston*.—An old farm pond. The basin of the pond is mud, but nearly all round this is flat ground several yards in width. This is covered with 5 or 6 inches of water when the pond is full. This shallow is a mass of matted *Glyceria fluitans* and in places *J. communis*. The pond proper can only be dredged when the water is low in summer. The pond contains *Ranunculus aquatilis* and Confervæ abundantly and some duckweed, *L. minor*.

In 1933 the pond was dry but the mud wet; in 1934 some rain in August kept it going.

The pond has been known to hold *L. pereger* for twenty years. About 1928 *H. jenkinsi* was taken for the first time, and on 5th April, 1934, *L. stagnalis* and *P. albus*. Later in the year, when the water fell, the pond was dredged. *S. lacustre* and *P. milium* were taken in the mud. *L. stagnalis* increased in numbers all

through the year, and by September no *L. pereger* could be seen and it was difficult to find one. 1934.

Pond very full. *L. stagnalis* very numerous, only one *L. pereger* found by dredging. May, 1935.

(29) *Sheep High*.—An old farm pond in bad condition, dries in most summers. Quite dry and hard in 1933. In May there was about a foot of water. Pond very heavily weeded with *Ranunculus aquatilis*, *Potamogeton densus*, *Zannichellia palustris*, and *Glyceria fluitans* all round the edge. *S. lacustre* found freely in the mud. A few weeks later the pond was overgrown with weeds, the *Glyceria* in particular encroaching over the pond. By July the pond was dry, the mud in the centre hard and cracked, the weeds dead, but the *Glyceria* covering nearly all the pond was alive though lying flat. It is probable under this thick mass there is sufficient moisture to keep the *S. lacustre* alive. 1934.

(30) *Oxendean*.—An old farm pond in very bad condition. It only holds water in wet weather. Dry in 1933 and in 1934 except for a week or two in April. Quite hard and dusty by June, and remained dry for the rest of the year, except when rain fell. *L. truncatula* was most abundant on the banks of the pond in April and on the mud in May, when the water fell. There are no signs of any other mollusca. 1934.

SUMMARY.

Ten species of mollusca occur in these ponds: *L. pereger*, *L. stagnalis*, *L. truncatula*, *H. jenkinsi*, *P. albus*, *P. crista*, *S. lacustre*, *P. casertanum*, *P. milium*, and *P. nitidum*.

Three heavily muddied ponds are noticeable for the number of species they contain: Friston, with six; East Dean Road, with four; and High and Over, with four species. Only the last is a cemented pond, but now contains so much mud that it is equivalent to a puddled one.

All the species can be found amongst them except *L. truncatula*. In no other ponds does more than one species occur. *L. truncatula* occurs once and *L. stagnalis* once also.

The only species which show anything like a general dispersal are *L. pereger* and *S. lacustre*, and each has an essential condition.

For *L. pereger* it appears absolutely necessary that the pond must hold a good supply of water, with no likelihood of any shortage. Probably in a cement pond if the water gets low it becomes warm and loses its aeration, and the cement sides become too hot for the snails to crawl out on.

Thirty-three ponds have been visited. From them must be deducted six derelict, two foul condition, and three drying ponds.

There are also six ponds which have been "cleaned". As they are not known to have held *L. pereger* before cleaning and do not now, they must be omitted also. This leaves sixteen possible habitats. *L. pereger* does occupy eleven of them, and *L. stagnalis* another.

Of the four unoccupied ponds, three certainly are verging on low water. In two of them land drainage has been turned in, evidently to help with this deficiency. The fourth pond, used by cattle, appears to be subject to raking at intervals to clear it from manure.

It may thus be said *L. pereger* has found its way into practically every pond suitable to its requirements. It is more than likely that the cleaned ponds did contain this snail. Take those in the Beachy Head group—nine good ponds, five occupied by *L. pereger*. It is strange if the others were blank, as the ponds are comparatively close together, and in the case of three of these the cleaning can be seen to have been very thorough; one was relined throughout.

For *S. lacustre* a plentiful supply of water is not a necessity; but there must be some mud in addition to the vegetable deposit.

Leaving out the derelict farm ponds, there are eleven ponds on these Downs with more or less mud in their deposit. Two are in a very foul condition, but the remaining nine all hold *S. lacustre*, notwithstanding the fact that two were dry and hard in 1933 and 1934 and several had only a few inches of water over the mud.

SPECIES RECENTLY INTRODUCED INTO THE PONDS.

From the notes it will be seen that additional species have appeared in two ponds, Friston and High and Over, whilst they have been under observation. Both ponds lie alongside the road, and in recent years some miles of road have been remade in their neighbourhood, for which they supplied water for the use of the steam-roller; the water being pumped from the ponds into a water cart. This cart possibly came up on to the Downs full of water as a supply for the journey; even if it did not, it would be certain to contain some water and mud from previous fillings. Standing in the pond to refill, the overflow would introduce some of this ditch-water and mud into the pond, with possibly some snails or spawn. The dates at which road-making took place appear to confirm this surmise. They were kindly furnished by the Surveyor of the East Sussex County Council.

Friston Pond.

The water-cart was at the pond in 1926, 1929, and 1932. This pond is known to have held *L. pereger* since 1910. In 1928 or 1929 *H. jenkinsi* was taken for the first time. On 15th April, 1930, a visit to the pond produced *L. pereger* and *H. jenkinsi* only. On 5th April, 1934, in addition to the above species, *L. stagnalis* and *P. albus* were taken. *L. stagnalis*, especially the adult snails, were easily detected without dredging. In number they were about equal to *L. pereger*. This species could not have been overlooked for years. It must have been introduced with *P. albus* in 1929 or 1932. The bivalves in the pond are not taken into consideration, as the pond was not thoroughly dredged before April, 1934.

High and Over Pond.

The water-cart was at this pond in 1930, and again when the road was widened, probably 1932. *L. pereger* has been seen and taken here since 1927. It was not dredged. It was carefully dredged for the first time on 19th April, 1932. *P. nitidum* was taken freely and *P. casertanum* in lesser numbers. The pond was dredged again on 1st May, 1934. *S. lacustre*, both adult and young, was immediately taken with the two species of *Pisidia*. This species cannot have been established in the pond in April, 1932, and been overlooked. It is quite possible now to dredge 10-12 *S. lacustre* without finding any *Pisidia*.

Pond Weeds.

There are only five heavily weeded ponds, all with much mud—Friston, East Dean Road, Sheep High, High and Over, and Crow Link. The first three, puddle ponds, carry a general crop with a good deal of *Glyceria* encroaching on them as the water falls in summer. High and Over has a very thick bed of *Potamogeton lucens* and Crow Link becomes very foul from its shortage of water and decay of *Chara fragilis*.

The cement ponds carrying plenty of water (vegetable deposit) usually are very lightly weeded; one or more of *Zannichellia* or similar *Potamogeton* and *Ranunculus aquatilis*. In ponds containing mud, the crop of weed is on similar lines but generally heavier. In some ponds *Conferva* is very thick. With only two species of mollusca showing anything like a general distribution among the ponds it does not seem possible to connect the weeds with the dispersal of the snails. *Confervæ* on the feet of birds might act as a carrier of spawn or young snails.

LIST OF PONDS

CEMENTED

No.	Name	Height Feet	Condition	Weeds	Mollusca
1.	Pashley.	542	Cleaned, 1933.	—	<i>L. peregér</i> (formerly).
2.	Beachy Head Road, I.	494	Cleaned, 1933.	—	<i>L. peregér</i> , 1935.
3.	Beachy Head Road, II.	488	Cleaned, 1933.	—	<i>L. peregér</i> (formerly).
4.	Black Robin Bottom.	353	Derelict.	—	<i>L. peregér</i> , 1935.
5.	East Hale Bottom.	278	Deposit. Manure. Cleaned, 1934.	—	<i>L. peregér</i> (formerly).
6.	Wigden's Bottom.	190	Cleaned, 1933.	—	<i>L. peregér</i> , 1935.
7.	S. of Polo Ground.	450	Derelict.	—	<i>L. peregér</i> (formerly).
8.	Bullock Down Farm.	450	Cleaned, 1933.	—	<i>L. peregér</i> , 1935.
9.	Bullock Down, I.	370	Cleaned, 1933.	—	—
10.	Bullock Down, II.	420	Cleaned, 1933.	—	<i>L. peregér</i> , 1935.
11.	Belle Tout (below).	150	Cleaned, 1933.	—	—
12.	Crow Link.	140	Foul. Thick deposit.	Heavy. <i>Chara fragilis</i> .	—
13.	Pea Down.	200	Deposit. Manure.	None.	None.
14.	Down's Golf, E. of,	470	Deposit. Mud.	Little. <i>Zann. palustris</i> .	<i>S. lacustre</i> .
15.	Hill Cottages.	630	Deposit.	Little. <i>Pot. pectinatus</i> .	<i>L. peregér</i> .
16.	Willingdon Golf.	250	Cleaned (1933 ?).	None.	—
17.	Oxendean.	240	Foul. Thick deposit.	None.	<i>S. lacustre</i> .
18.	Bourne Hill.	450	Cleaned, 1933. Deposit. Mud.	None.	<i>S. lacustre</i> .

No.	Name	Height Feet	Condition	Weeds	Mollusca
19.	Ratton Park.	300	Deposit. Manure.	Little. <i>Ran. aquatilis</i> .	<i>L. stagnalis</i> .
19a.	"	400	Derelict.	—	—
20.	Ratton (above Willingdon).	320	Deposit. Manure.	Little. <i>Confervæ</i> . <i>Ran. aquatilis</i> .	—
21.	Hanging Hill (Filching).	320	Cleaned (1933 ?). Deposit. Manure.	Little. <i>Ran. aquatilis</i> . <i>Zann. palustris</i> .	None. <i>S. lacustre</i> , 1935.
22.	Water Works Drive.	150	Derelict.	—	—
23.	Middle Brow, E. of West-dean.	150	Deposit.	Algæ.	<i>L. pereger</i> .
24.	Long Man.	280	Deposit.	Little. <i>Pot. pusillus</i> .	<i>L. pereger</i> .
25.	High and Over.	245	Deposit. Mud.	Thick. <i>Pot. luteus</i> . <i>Ran. aquatilis</i> . <i>Chara fragilis</i> .	<i>L. pereger</i> . <i>S. lacustre</i> . <i>P. casertanum</i> . <i>P. nitidum</i> . <i>S. lacustre</i> (dead).
31.	Snap Hill.	310	Deposit. Mud.	Little. <i>Ran. aquatilis</i> .	—
32.	Charlston Bottom.	200	Derelict.	—	—
UNCEMENTED					
26.	East Dean Road.	360	Mud.	Heavy. <i>Ran. aquatilis</i> . <i>Zann. palustris</i> .	<i>L. pereger</i> . <i>P. crista</i> . <i>S. lacustre</i> . <i>P. milium</i> .
27.	Peakdean.	240	Derelict.	—	—
28.	Friston.	350	Mud.	Thick. <i>Ran. aquatilis</i> . <i>Lemna minor</i> .	<i>L. pereger</i> . <i>L. stagnalis</i> . <i>H. jenkinsi</i> . <i>P. albus</i> . <i>S. lacustre</i> . <i>P. milium</i> . <i>S. lacustre</i> .
29.	Sheep High Cottages.	350	Mud.	Heavy. <i>Ran. aquatilis</i> . <i>Pot. densus</i> . <i>Zann. palustris</i> .	—
30	Oxendean.	220	Mud.	None.	<i>L. truncatula</i> .

VERTIGO GENESII GREDLER IN CENTRAL IRELAND.

By R. A. PHILLIPS, M.R.I.A.

(Read before the Society, 11th May, 1935.)

THE discovery in 1924 of *Vertigo genesii*,¹ first in a fossil state in King's County and then as a living species in Queen's County, suggested the probability that it would be found living in other parts of Ireland. After repeated searches in likely-looking ground in many localities during subsequent years I was at last successful in finding, on the 18th October, 1931, four living specimens in a mixed gathering of *Vertigo* and other mollusca collected on that day at Fiagh Bog near Borrisokane, Co. Tipperary.

Bearing in mind, and guided by the nature of, the habitat at that locality, I again, two years later, met with *V. genesii* in similar spots in bogs near Ballinasloe and near Tuam, Co. Galway. At each of those localities the habitat lies on the margin of an extensive peat-bog at spots which during summer and autumn are damp or spongy, according to the amount of rainfall, and during winter and spring are usually in a more or less swampy condition, places where the flora of the adjoining pasture lands mingles with that of the bog and marsh, producing a thick, luxuriant vegetation composed largely of grass, sedge, and rush.

In August, 1934, I found the species living near Roscrea, Co. Tipperary, the habitat there being small, dense patches of bog-rush, sedge, and grass in a wet hollow, watered by springs, at the foot of a hill-side pasture.

Details of these new localities and the vice-counties in which they are situated are :—

TIPPERARY NORTH.

(1) Fiagh Bog, 3 miles north-east of Borrisokane, October, 1931, and on three subsequent dates. Luxuriant beds of bog-rush (*Schænus nigricans*) among which grow various grasses including *Molinia*, *Festuca ovina*, *Agrostis alba*, *Holcus lanatus*, *Poa trivialis*, *Anthoxanthum*, with *Carex* spp. and *Eriophorum*, by the sides of shallow drains which separate the bog from the road which runs across it. *Vertigo moulinsiana*, in abundance, accompanies *V. genesii* at this locality.

(2) Near Roscrea, August, 1934, also February, 1935. About 2 miles north-west of the town, by the Birr railway in a small wet field between the railway embankment and hilly pasture-land. *V. genesii* sparingly in small tufts or stools of *Schænus nigricans*

¹ *Journ. of Conch.*, vol. 17, 1925, pp. 236–240.

with a mixture of *Juncus obtusiflorus*, *Molinia*, *Festuca ovina*, other grasses, and various sedges. This habitat is much interfered with and curtailed by the grazing and trampling of cattle. The place is not far from Golden Grove and Gloster, King's County, where the shell was first discovered, as a fossil, in Ireland by Mr. A. W. Stelfox. *V. moulinsiana* lives in a similar habitat less than a quarter of a mile distant.

GALWAY SOUTH.

Pollboy Bog, 2 miles south of Ballinasloe, September, 1933, and July, 1934. A wet peaty spot near the bank of the canal which passes through the bog. *Juncus conglomeratus*, *J. articulatus*, *Molinia*, and various pasture grasses and sedges growing with, or close to, typical bog plants such as *Scirpus cæspitosus*, *Eriophorum vaginatum*, *Drosera*, *Erica tetralix*, *Osmunda*, etc. *V. genesii*, adult and juvenile, seen crawling and resting on soft over-mature leaves of grasses and sedges on a damp day in July. The habitat is in the midst of a thicket of gorse interspersed with willows, birches, and bog myrtle.

GALWAY NORTH.

Cloonascragh Bog, 2 miles south of Tuam, October, 1933, and July, 1934. *V. genesii* fairly plentiful in marshy spots where the edge of the bog meets the base of an extensive esker ridge. Pasture grasses dominant, with *Molinia*, *Juncus* spp., *Carex* spp., *Typha*, *Spiræa*, *Menyanthes*, *Hydrocotyle*, and other moisture-loving plants. Adults and juveniles were plentiful in July.

Thus, all the known localities for *Vertigo genesii* in Ireland occur at intervals of approximately 20 miles along a line running north-west for about 75 miles across the Central Limestone Plain from Mountmellick and Roscrea to Tuam.

Each habitat is either directly connected with, or lies within a mile or two of, one of the great lowland peat-bogs which form such characteristic and remarkable features on the surface of Central Ireland.

This distribution leads to the conclusion that *V. genesii* probably lives in suitable spots throughout the midland counties of Ireland. There is no apparent reason why it should be absent from other parts of the country, but frequent searches for it in bogs and marshy places in the south and west have, so far, been unsuccessful. As the shell occurs in fossil deposits in England and in Scotland, it seems quite likely that it still exists in a living state in those countries, possibly in damp grassy places on moors or near the edges of marshes. Gredler's original habitat for the species was "an alpine pasture" near Bozen in the Tyrol.

Vertigo genesii appears to require a more specialized habitat than most other Irish members of the genus. *V. pygmæa*, *V. antivertigo*, *V. substriata*, and even *V. lilljeborgi* and *V. moulinsiana* may all be found adapting themselves, in their respective habitats, to various situations, such as under or among stones, under logs, in layers of decaying vegetable matter as well as on growing plants, but *V. genesii*, so far as I could discover, seems to confine itself to the living vegetation in places that are permanently damp or semi-swampy, particularly to spots where the finer-leaved grasses and sedges, even though growing among rushes and larger plants, are dominant and dense, their roots and lower parts standing in wet soil, or sometimes in shallow water, their upper parts luxuriant and leafy.

As the little snails shelter and are hidden among the leaves and stems during the summer and autumn months, the easiest way to detect their presence and obtain specimens is to cut handfuls of the herbage close to the ground, shake them over a sheet of paper or other material, and pick out the *Vertigo* and associated molluscs from among the débris. This can be done in the field. By those means the mollusca associated with *V. genesii* in each of the four habitats here dealt with were found to be :—

Vertigo pygmæa, *V. antivertigo*, *V. substriata*, *Agriolimax lævis*, *Hyalinia crystallina*, *Hy. radiatula*, *Zonitoides nitidus*, *Euconulus fulvus*, *Punctum pygmæum*, *Cochlicopa lubrica*, *Succinea pfeifferi*, *Carychium minimum*, and *Limnæa truncatula*. In addition *Hygromia hispida*, *Vallonia pulchella*, and *Pupa anglica* were present at Fiagh and Roscrea. *Columella edentula* occurred at Fiagh, Pollboy, and Cloonascragh, and, as already mentioned, *Vertigo moulinsiana* was an abundant associate at Fiagh Bog.

Occasional specimens, mostly dead shells, of *Limnæa pereger*, *Planorbis contortus*, *Pisidium cinereum*, and *P. personatum* also appeared, but could not be regarded as associates of the land species.

Though habitually living under moist conditions and probably subject to occasional submergence, *V. genesii* can evidently exist for long periods in a perfectly dry atmosphere. Three specimens, collected at Fiagh Bog on 25th November, 1934, which were forgotten and left by themselves in a small glass tube (2 in. $\times$ $\frac{1}{2}$ in.) appeared to have quite dried up when rediscovered early in February, 1935, but crawled about quite actively when a narrow strip of moistened paper was placed with them in the tube.

The plants occurring most frequently among the species which compose the floral associations of the *V. genesii* habitats are :—

Juncus obtusiflorus, *J. conglomeratus*, *J. articulatus*, *Schoenus nigricans*, *Eriophorum angustifolium*, *Triglochin palustre*, *Eleocharis*

palustris, *Carex teretiuscula*, *C. echinata*, *C. vulgaris*, *C. glauca*, *C. panicea*, *C. flava*, *C. hirta*, *Anthoxanthum odoratum*, *Agrostis canina*, *A. alba*, *Holcus lanatus*, *Molinia cœrulea*, *Poa trivialis*, *P. pratensis*, *Festuca elatior*, *F. ovina*.

Ranunculus flammula, *Cardamine pratensis*, *Viola palustris*, *Lychnis flos-cuculi*, *Potentilla palustris*, *Epilobium palustre*, *Hydrocotyle vulgaris*, *Galium palustre*, *Scabiosa succisa*, *Menyanthes trifoliata*, *Mentha aquatica*, *Orchis maculata*, *O. ericetorum*, *O. latifolia*.

Larger plants which grow among the foregoing but are not apparently frequented by *V. genesii* are : *Spiræa ulmaria*, *Angelica sylvestris*, *Cnicus palustris*, *C. pratensis*, *Lythrum salicaria*, *Typha latifolia*, *Phalaris arundinacea*, *Phragmites*, *Salix aurita*, *S. cinerea*, *Myrica gale*. Moss (*Hypnum* spp.) is sometimes plentiful among the other plants but is shunned by *V. genesii*.

The rushes (*Schoenus* and *Juncus* spp.) serve a useful purpose in protecting habitats to which browsing animals have access as, being hard and unpalatable, cattle usually pass the spots where they are dominant, thus allowing the grasses and other leafy plants which grow among them and are essential to the well-being of *V. genesii* to develop and mature.

No actual tests were made as to whether the soil of those Irish habitats was of an alkaline or acid nature. The Pollboy habitat, however, is on pure peat and undoubtedly acid. The Cloonascragh and Fiagh habitats, being on the margins of bogs where the layers of peat are thin, disintegrated, and mixed with the marly subsoil and matter washed in from the adjoining esker and other limestone surroundings, are probably more or less alkaline. The Roscrea habitat also appears to be alkaline, as the whole district is calcareous and overlying peat is not present in the neighbourhood.

It therefore seems probable that *V. genesii* is indifferent as to the presence or absence of lime in its immediate surroundings.

Testacella in Sussex.—Two species of *Testacella* have occurred regularly in the St. Leonards district at any rate for the past ten years. *T. haliotideia* is fairly common in the gardens at Beauport Park, and has been sent or shown to me by Mr. Grinstead, the bailiff, on various occasions. *T. scutulum* occurs regularly but sparingly every spring in my own garden.
—J. R. LE B. TOMLIN.

NOTES ON THE SNAILS OF THE MULLET, WESTERN MAYO.

By C. OLDHAM.

(Read before the Society, 9th March, 1935.)

A. W. STELFOX'S contribution to the survey of Clare Island in Co. Mayo, undertaken by the Royal Irish Academy some twenty-five years ago, was an account of the Land and Freshwater Mollusca, not only of Clare Island itself but of other islands and of districts on the near-by mainland.¹ One of these districts is the Mullet Peninsula, a bare, isolated region, almost an island. The peninsula consists of several low rocky masses, once islands but now connected with one another by extensive areas of blown sand, bare dunes, and flat areas more or less covered by sward. There are four large shallow lakes and some smaller pools with sandy beds. Stelfox's time for field work on the Mullet was limited to an evening and the whole of the next day (30th and 31st March, 1910) when, despite unfavourable weather—a dry, cold north wind—he observed thirty-eight species.²

In June, 1933, and July, 1934, I spent a few days on the Mullet, and with more leisure and better weather conditions I was able to add eight species, found alive, and from débris at Lough Leam, other four species. This débris comprised a miscellaneous assemblage of land and freshwater snails, some of which, judging by the condition of their periostraca, had not long been dead, and others, perhaps not always of the same age, which had been washed out of the crumbling sand of the dunes on which the lake is encroaching on its north-west margin.

Of the species found alive, but not seen by Stelfox, one, *Paludestrina jenkinsi*, has probably arrived since his visit; the others are, as probably, old colonists; but all are perhaps worth brief mention.

Clausilia rugosa (Drap.). In the sward among the rocks on Annagh Head. A short tumid form, apparently var. *septentrionalis* (A. Schmidt); the mean dimensions of six examples are 8.8×2.4 mm.

Vallonia excentrica Sterki.³ Several under pieces of board on the blown sand near Lough Leam.

¹ Clare Island Survey, Part 23, Land and Freshwater Mollusca, *Proc. Roy. Irish Acad.*, vol. xxxi.

² Mr. Stelfox tells me that a thirty-ninth species—*Paludestrina ventrosa*—was included in his Mullet list in error.

³ Mr. Stelfox tells me that when writing his report he did not discriminate between *V. pulchella* and *V. excentrica*, and that the shells there referred to as *pulchella* were in fact *excentrica*.

Physa fontinalis (L.) }
Bithynia tentaculata (L.) } Among *Chara* in a shallow pond on
the blown sand a mile north-west of Aghleam.

Paludestrina jenkinsi (Smith). In a trickle of water among the dunes near Binghamstown; abundant in the Loughs of Termoncarragh, Leam and Ardmore. The Lough Leam shells are very tumid and quite unlike those from the other stations.

Pisidium cinereum (Alder) }
P. subtruncatum (Malm) } In a trickle among the dunes near Binghamstown.

P. lilljeborgii (Cless.). In the sandy bed of Lough Ardmore, associated with a peculiar form of *P. nitidum*, in which the posterior margin is much truncated and slopes steeply to the ventral margin and the umbonal striæ are unusually pronounced, a form very near, Mr. Stelfox says, to his var. *arenicola*. The sandy bed of Cross Lough seems suitable for *P. lilljeborgii* and I looked for it in several places, but in vain. Mr. Stelfox tells me, however, that some time after the publication of his report he discovered a single young shell in a gathering of *P. nitidum* from this lake.

LOUGH LEAM.

Lough Leam, south-west from Binghamstown, is a shallow lake, flooded by salt water at spring tides. No marine species and, apart from *Paludestrina jenkinsi*, no brackish water species now live in the lake, although large numbers of dead shells of *Mya arenaria* are embedded, still erect, in the sandy bed, and a few dead shells of a *Rissoa* were seen in the jetsam on the shore. In 1910 Stelfox found *Paludestrina stagnalis* in abundance; I saw none. These facts suggest that not long ago the lake was more saline than it is to-day; but, be that as it may, the water at some slightly earlier period must have been less saline than it is to-day and have supported a considerable freshwater fauna.

Shells of land and of freshwater species are to be seen embedded in the blown sand on the north-western edge of the lough; and these, washed out of the crumbling sand cliff, are associated with shells of other species such as *Vitrina pellucida*, *Helicella itala*, *Cochlicella barbara*, *Vallonia* spp. and *Cepæa nemoralis*, that have probably been washed or blown into the lough from the sward, and others such as *Hyalinia alliaria*, *H. radiatula*, *Cochlicopa lubrica*, *Vertigo antivertigo*, *V. pygmæa*, *Succinea pfeifferi*, and *Limnæa truncatula*, which may still survive in the adjoining marsh, and *Paludestrina jenkinsi* which lives in the lough, in the miscellaneous débris that has drifted into little depressions in the floor of the

lough, or as jetsam on its shore. Whilst the age of individual shells in the débris may be doubtful it is certain that all the species, whether still surviving or not, were living in or near the lough not long ago. About as much of this drifted débris as would fill a quart measure was washed and cleaned; the residual shells comprised thirty species, of which four, marked with an asterisk, are additions to Stelfox's Mullet list. An attempt to show their relative frequency has been made by assigning them in the following list to four classes: A, from one to six specimens (giving actual numbers); B, from seven to twenty-five; C, from twenty-six to a hundred; D, exceeding a hundred.

Vitrina pellucida (Müll.), B. All fresh shells.

Hyalinia alliaria (Miller), A. Four.

H. radiatula (Alder), A. Three.

H. crystallina (Müll.), A. One.

Punctum pygmæum (Drap.), B. Most of the shells with periostracum in good condition.

**Sphyradium edentulum* (Drap.), A. One. An elongate shell devoid of periostracum.

Helicella itala (L.)
Cochlicella barbara (L.) } B. All "live" shells.

Vallonia pulchella (Müll.)
**V. excentrica* Sterki. } D. Many of the shells are clearly

referable to one or the other, but the specific identity of some is uncertain.

Cepæa nemoralis (Müll.), B. All "live" shells.

Cochlicopa lubrica (Müll.), D. Mostly fresh shells, derived presumably from the sward.

Pupa anglica (Fér.), A. One. An adult, devoid of periostracum.

P. muscorum (L.), A. Three. Worn shells, lacking periostracum, and probably coeval with the *Sphyradium edentulum* and *Pupa anglica*. The extensive sandy areas in the Mullet are, judged by English criteria, ideal for this species; and it is puzzling to explain why, if there at all, it should not be found alive and in abundance. In the area of the Clare Island survey Stelfox found it only on Inishbofin and there only as a fossil.

Vertigo antivertigo (Drap.), D. Varies much in size; some of the shells obviously fresh.

V. pygmæa (Drap.), B. Varies in size and condition like the last.

Clausilia rugosa (Drap.), A. Six. All worn shells.

Succinea pfeifferi Rossm., C. Most of the shells are fossilized, but others quite fresh. This species is not uncommon in damp places in the sward of the blown sand areas.

Carychium minimum (Müll.), B. Some fossilized, others fresh.

Limnæa pereger (Müll.), D. In great abundance. The majority have tall spires and narrow mouths, but there is considerable variation in both respects.

L. palustris (Müll.), A. One. A small worn shell.

L. truncatula (Müll.), D. Some fossilized, but most quite fresh.

Planorbis crista (L.), D. All var. *lævigata* Adami, i.e. lacking crests.

P. glaber Jeff., D. Some retain periostracum in varying degrees but none is quite fresh.

P. spirorbis (L.), B. All lack periostracum.

Aplecta hypnorum (L.), A. One. A young shell.

**Paludestrina jenkinsi* Smith, D. In great abundance ; now living in the lough. All the empty shells in the débris obviously not long dead.

**Pisidium cinereum* Alder, A. Six.

P. nitidum Jen., D. In extraordinary abundance, outnumbering the shells of all the other species together. In many of the shells the truncated posterior margin slopes steeply to the ventral margin, but not in so marked a degree as in the living shells in Lough Ardmore.

P. personatum Malm., A. Two.

ERRIS.

Succinea pfeifferi, *Paludestrina jenkinsi*, and *Pisidium lilljeborgii* at Carrowmore Lake, 8 miles south-east of Belmullet, are additions to Stelfox's list for the district of Erris.

All the shells are now in the Irish National Museum, Dublin.

Testacella eating Milax.—Some time ago I found a *Testacella maugei* crawling up a wall in Berriedale Avenue, Hove. I believe that it is not recorded from Sussex. I put it in a tin with a *Milax sowerbii* half as big again as itself. Looking into the tin that evening I saw that the *Testacella* had got the tail of the *Milax* well into its mouth and that the latter was making frantic efforts to escape by curling round from side to side over the *Testacella*'s back. With some difficulty I pulled them apart with two pads of cotton-wool and found the tail of the *Milax* shrivelled. It died the next day. I gave the *Testacella* a live worm about three times its length and next evening only the extreme head-end of the worm was lying in the tin, and the slug was much puffed out and very torpid. Curiously enough I found a *T. haliotidea* on a step in the same road a day or two later, the first I had ever seen in Hove, though I see that it is recorded from several places in Sussex.—A. G. STUBBS.

THE DATES OF PUBLICATION OF FORBES AND HANLEY'S HIST. BRIT. MOLL.

By NORA FISHER and J. R. LE B. TOMLIN.

FORBES and Hanley's *A History of British Molluscs and their Shells* was issued in parts between 1848 and 1853. The dates of publication of some of the parts have been given by Woodward (*Journ. Conch.*, 10, p. 47, 1901) and Reynell (*Proc. Malac. Soc.*, 13, pp. 25-6, 1918), but in each case from an imperfect set. Recently one of us obtained a set of parts in the original covers, complete save for one part. Fortunately the part wanting from this set is one whose date of publication is already known.

The following is a complete list of the parts with their contents and dates of publication.

<i>No. of Pt.</i>	<i>Pages.</i>	<i>Plates.</i>	<i>Date</i>
1	1-40	A-B, 1-2	1st Jan., 1848.
2	41-80	C-D, 3-4	1st Feb., 1848.
3	81-120	E, 5-7	1st March, 1848.
4	121-160	F, 8-10	1st April, 1848.
5	161-200	G, 11-13	1st May, 1848.
6	201-240	H, 14-16	1st June, 1848.
7	241-280	I, 17-19	1st July, 1848.
8	281-320	K, 20-2	1st August, 1848.
9	321-360	L, 23-5	1st Sept., 1848.
10	361-400	N, 26-8	2nd Oct., 1848.
11	401-440	O, 29-31	1st Nov., 1848.
12	441-477	M, 32-4	1st Dec., 1848.

On p. 477, "end of volume 1." Then comes advertisement page, "Temporary Title-page," for vol. 1, with Notice on back, and "(Temporary) Contents of the First Volume".

<i>No. of Pt.</i>	<i>Pages.</i>	<i>Plates.</i>	<i>Date.</i>
13	1-40	P, 35-7	1st Jan., 1849.
14	41-80	R, 38-40	1st Feb., 1849.
15	81-120	Q, 41, 43-4	1st March, 1849.
16	121-160	S, 45-7	2nd April, 1849.
17	161-200	U, 42, 48-9	1st May, 1849.
18	201-240	50-53	1st June, 1849.
19	241-280	AA, 54-6	2nd July, 1849.
20	281-320	BB, 58-9, 61	1st August, 1849.
21	321-360	NN, 57, 62-3	1st Sept., 1849.
22	361-400	DD, 64-6	1st Oct., 1849.
23	401-440	FF, 60, 67-8	1st Nov., 1849.
24	441-480	II, 69-71	1st Dec., 1849.
25	481-520	CC, 72-3, 77	1st Jan., 1850.
26	521-557	T, 74, 78-9	1st Feb., 1850.

On p. 557, "end of volume 2." Rest as at end of vol 1.

<i>No. of Pt.</i>	<i>Pages.</i>	<i>Plates.</i>	<i>Date.</i>
27	1-40	EE, 83-5	1st March, 1850.
28	41-80	GG, HH, 80, 86	1st April, 1850.
29	81-120	JJ, 75-6, 81	1st May, 1850.

<i>No. of Pt.</i>	<i>Pages.</i>	<i>Plates.</i>	<i>Date</i>
30	121-160	LL, 82, 87, 115	1st June, 1850.
31	161-200	KK, 88, 116-17	1st July, 1850.
32	201-240	OO, 118-120	1st August, 1850.
33	241-280	PP, 89, 92, 121	1st Nov., 1850.
34	281-320	SS, 90-1, 93	2nd Dec., 1850.
35	321-360	RR, 94-6	1st Jan., 1851
36	361-400	SS, 97, 99-100	1st Feb., 1851.
37	401-440	TT, 101-3	1st March, 1851.
38	441-480	UU, 104-6	1st April, 1851.
39	481-520	VV, 107-9	1st May, 1851
40	521-560	110-13	2nd June, 1851.
41-2 (in one pt.)	561-616	YY, ZZ, 98, 114, 114A, 114B, 114C, 114D	1st Sept., 1851.

“End of the Third Volume.” Rest as at end of other vols.

<i>No. of Pt.</i>	<i>Pages.</i>	<i>Plates.</i>	<i>Date.</i>
43	1-40	DDD, 114E, 114F, 123	1st Jan., 1852.
44	41-80	FFF, 124-6	2nd Feb., 1852.
45	81-120	EEE, 129-131	1st March, 1852.

Cover titled “Part 7”, but crossed out in ink and “45” added below. Date also crossed out and “1st March 1852” inserted. All the covers of the remaining parts are similarly altered. Evidently old wrappers were utilized for the later parts (parts 45-51).

<i>No. of Pt.</i>	<i>Pages.</i>	<i>Plates.</i>	<i>Date.</i>
46	121-160	FFF, 122, 127-8	1st April, 1852.
47	161-200	HHH, KKK, LLL, MMM	1st July, 1852.
48	201-240	BBB, OOO, PPP, QQQ	1st Sept., 1852.
49	241-280	AAA, CCC, 132-3	1st Dec., 1852.
50-1 (in one pt.)	281-301	W, MM, III, JJJ, NNN, RRR, SSS	1st May, 1853.

Parts 50-1 also contain the title-page, Preface (pp. vii-ix), Introduction (pp. xi-xxxvi), General Index (pp. xxxvii-lxxv), Contents (pp. lxxvii-lxxx), and “Explanation of the Plates of Animals”, pp. 479-486.

Two of the plates in the set from which these details are taken are incorrectly lettered. Plate SS, issued with part 34, ought to be marked XX; on p. 484 of vol. 1 it is stated that “A few impressions of this plate were issued, marked SS”. Plate FFF, issued with part 44, ought to be marked GGG; on p. 485, vol. 1, we are told that “A few impressions were issued of a plate so marked; these should be altered to GGG. There is no plate FFF”.

From this it would seem that the present copy of the work is a very early impression.

FLOOD-DÉBRIS IN POLAND.

By ANTON JANKOWSKI.

IN the second half of July, 1934, there was great flood in Poland, embracing the south-western part of the country and originating in the exceptionally heavy rainfall in the Carpathian Mountains. Prior to that I was on a trip collecting mollusca, and not being able to continue further collecting because of the heavy rain, I went back in the direction of Warszawa, stopping here and there as weather conditions permitted, and after all I stopped for a few weeks at Józefów, belonging to Count R. Rostworowski, an estate on the right, high bank of the River Wisla (about 180 km. south from Warszawa), where I awaited the flood. There was a fine park just close to the river and a sloping narrow pass terminating just at the water margin. During the flood a part of this pass was invaded by flood too. After the flood was over there were left in that ravine heaps of flood débris (broken branches, small pieces of wood, bark, roots, straw, ears of corn, seeds, etc.). I noticed there a lot of small dead mammals, birds, beetles, and mollusca, the last very numerous and mostly *Cecilioides acicula* (Müll.), a rare species wherever it occurs. I got in a small bag a portion (about 5 litres) of the débris, being careful to take it from the top to the bottom of the layer, in order to possess an average sample of the whole deposit left in the ravine. After drying and sifting the contents I picked over 5,300 specimens (about forty species), belonging mostly to small species. They are as follows:—

<i>Valvata piscinalis</i> (Müll.) .	13	<i>Vertigo antivertigo</i> (Drap.) .	114
<i>Bithynia tentaculata</i> (L.) .	3	<i>Vertigo pygmæa</i> (Drap.) .	121
<i>Galba truncatula</i> (Müll.) .	5	„ <i>angustior</i> Jeffr. .	7
<i>Planorbis corneus</i> (L.) .	2	<i>Pupilla muscorum</i> (L.) .	385
<i>Tropidiscus planorbis</i> (L.) .	12	<i>Vallonia pulchella</i> (Müll.) .	520 ¹
<i>Spiralina vortex</i> (L.) .	9	„ <i>enniensis</i> Gredl. .	10 ²
„ <i>vorticulus</i> Trosch. .	5	„ <i>costata</i> (Müll.) .	40
<i>Anisus spirorbis</i> (L.) .	8	<i>Faminiia tridens</i> (Müll.) .	37
„ <i>leucostoma</i> (Müll.) .	1	<i>Clausilia</i> .	2 ³
„ <i>septemgyratus</i> Ziegl. .	14	<i>Cecilioides acicula</i> (Müll.)	3,400
<i>Gyraulus albus</i> (Müll.) .	10	<i>Punctum pygmæum</i> (Drap.)	2
<i>Bathyomphalus contortus</i> (L.)	41	<i>Vitrea inopinata</i> Ulicny .	25 ⁴
<i>Segmentina nitida</i> (Müll.) .	4	<i>Zonitoides nitidus</i> (Müll.) .	12
<i>Carychium minimum</i> Müll. .	3	<i>Euconulus fulvus</i> (Müll.) .	2
<i>Succinea putris</i> (L.) .	17	<i>Fruticicola fruticum</i> (Müll.)	
„ <i>pfeifferi</i> Rossm. .	3	(juv.)	10
„ <i>oblonga</i> Drap. .	3	<i>Zenobiella rubiginosa</i> A. Schm.	9
<i>Cochlicopa lubrica</i> (Müll.) .	75	<i>Perforatella bidens</i> (Chemn.)	10
„ „ <i>f. exigua</i> Mke. .	6	<i>Helix pomatia</i> L. (juv.) .	2
<i>Truncatellina cylindrica</i> (Fér.)	310	Fruticicolidae and Helicidae	68 ³

¹ One specimen sinistral.² The first record for Poland.³ Small specimens, not to be determined.⁴ Rare species in Poland, recorded till now from Podole only.

Beside the above species I picked also from different places of the débris *Lymnæa stagnalis* L. (1), *Hippeutis complanatus* (L.) (1), *Arianta arbustorum* (L.) (1), *Cepæa nemoralis* (L.) (2), *Cepæa vindobonensis* C. Pf. (1), and *Sphærium rivicola* Lam. (1).

Looking over the booty the following circumstances strike one : (1) Absence of Carpathian forms ; (2) Extraordinarily great quantity of *C. acicula*.

After giving due consideration to the matter, I came to the following conclusion.

The absence of Carpathian forms in the débris may indicate that the specimens are of local origin (Józefów and the close environs up the river), with the exception, of course, of *C. nemoralis*, a form of Western Europe, drifted from elsewhere, where it has been brought accidentally or on purpose. This supposition of the local origin of the specimens may be partly proved by the fact that with few exceptions the species listed above are common everywhere and as far as I could find in a comparatively short stay in Józefów, more than half of the terrestrial forms inhabit the park numerously (*C. lubrica*, *T. cylindrica*, *P. muscorum*, *V. pulchella*, *V. costata*, *Z. nitidus*, *F. fruticum*, *A. arbustorum*, *C. vindobonensis* and var. *pallescens*, and *H. pomatia*) and in addition *V. pellucida*, *Z. incarnata*, *T. hispida* ; sporadically, I found *S. oblonga*, *P. pygmæum*, *V. enniensis*, *J. tridens*, *H. lutescens*.

The abundance of *C. acicula* in the débris is due, I believe, to the geological condition of the region. The underlying rock is of cretaceous origin, forming numerous cracks all over the region, that may be inferred from heavy rainfall being soaked up very quickly. These underground cracks may create suitable habitats for *C. acicula* where they might flourish and die generation after generation without being detected, and only the rough waters of the heavy flood may wash them out to the surface.

EDITORIAL NOTES

WE have to deplore the loss of another of our Honorary Members, M. Philippe Dautzenberg, of Paris, who died on 9th May. His death will cast somewhat of a cloud over the Réunion Amicale which is being organized by the enterprise of the *Journal de Conchyliologie* for 4th–7th July and to which are invited the Conchologists, Malacologists, and Palæontologists of all nations. M. Dautzenberg was to have acted as one of three “Présidents d’Honneur”, the other two being M. E. L. Bouvier, of the Muséum National d’Histoire Naturelle, and M. H. Douvillé, of the École des Mines.

We congratulate Madame Henri Fischer and the other directors of our contemporary on the conception of so admirable a scheme and wish them every success in carrying it out.

The National Museum of Wales has recently been presented with the diary kept by the well-known naturalist L. W. Dillwyn from 1817 to 1852. I venture to cite one or two entries:—

Apr. 2, 1818. Received a letter from W. S. Millard begging for permission to dedicate a poem on Botany to me, and declined to accept it.

Dec. 20, 1820. Arrived at Bristol and spent the whole day in looking over the collections of Mr. Miller and Mr. Millard.

[The former is no doubt J. S. Miller, Curator of the Philosophical Institution of Bristol, who described *Oxychilus alliarius*, and whose name will be found in several places in Jeffrey’s *Brit. Conch.*, vol. 1.]

July 21, 1827. 200 *Ianthinae* picked up in Oxwich Bay.

Dillwyn also mentions that when in London he went to Mrs. Mawe’s to see the magnificent collection of shells belonging to Mrs. Bligh, “which appeared to be well worth the price asked, viz. £700.” I may note that this collection was subsequently sold by auction, the sale taking six days, from 20th–25th May, 1822.

It was catalogued by Swainson, who in an appendix to the sale catalogue described a number of new species. Mrs. Bligh was the widow of the famous Admiral William Bligh, of the *Bounty*, and owed most of her collection to her husband’s voyages in the Pacific. He was Captain Cook’s sailing-master on the *Resolution* for four years, and was appointed to the *Bounty* in 1787.

From a priced copy of the catalogue I gather that the shells realized a little over £1,100, and amongst individual prices are the following: *Scalaria pretiosa*, a very perfect specimen, £3 8s.; *Conus aurisiacus*, £12 1s. 6d.; *C. pulicarius*, £5 5s.; *Voluta fusiformis*, £28 17s. 6d.; *Conus textile*, 10s. 6d.; *Achatina zebra* (Algoa Bay), £2 15s.; *Strombus latissimus*, £6 16s. 6d.; *Cypræa argus*, £1 11s. 6d.; *Harpa costata*, 15 guineas; *Cypræa aurora*, £9 19s. 6d.; *Voluta imperialis*, £8 15s.

The death of “Grabham of Madeira” deserves some notice in our *Journal*, for among his multifarious interests and hobbies he certainly included Conchology and he was a member of the coterie which gathered round Lowe and Wollaston to investigate the natural history of Madeira.

In *Testacea Atlantica*, published in 1878, Wollaston already speaks of Grabham as celebrated far and wide. He was born on 9th January, 1840, graduated in medicine, and after serving as house surgeon at St. Thomas’s Hospital went to Madeira in 1861, and spent the rest of his life there, dying on 28th January last at the age of 95. The wideness of his interests was extraordinary: he was botanist, geologist, entomologist, musician, and many other things, but perhaps most distinguished for his researches in climatology: he served on the British Association Committee on Meteoric Dust, he was Bradshaw Lecturer when over 80 before the Royal College of

Physicians, and at the age of 88 he read an excellent paper on the deep-sea food fishes of Madeira before the 1928 British Association. As further evidence of his versatility it may be mentioned that he wrote on hybridization, atmospheric electricity, cable currents, and earthquakes.

He had a remarkable collection of clocks of all ages and designs.

We have not yet given any notice of a most artistic and useful monograph that appeared last year entitled "A Collection of Japanese Shells, with Illustrations in Natural Colours", by Professor Shintaro Hirase, of the Seikei High School. The book consists of 129 plates, with figures of shells printed in natural colour on a rather deep sea-blue background, and a catalogue of the figures with dimensions. In the case of some of the very small species the figures rather fail, but it is a great boon to have such a complete illustrated catalogue and we are under a considerable obligation to Professor Hirase for such a helpful piece of work.

In *Nature*, 8th June, 1935, appears an interesting letter from the Curator of the Perth (Australia) Museum on the Australian grey butcher bird (*Cracticus torquatus*).

It eats *Helix pisana*, which has obtained a foothold in the Perth district, either crushing it with its powerful bill or beating it on the ground, but it has not learned to use an anvil stone as our thrush does. Much of the shell is swallowed and subsequently disgorged in the pellet. This bird's diet is unusually wide, as in captivity it also eats raw meat, ants, and butterflies.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND

(Continued from p. 96.)

Exhibits.

By Mr. H. W. Worsfold : A small series of Japanese marine Gastropoda.

By Mr. A. E. Salisbury : Turridæ from Japan and from the Pacific.

By Mr. J. D. Dean : *Cypræa caput-draconis* Melvill from Easter Island.

By Mrs. Morehouse : *Helix pisana* Müller and *H. nemoralis* L.

By Miss N. Fisher : Holocene marine mollusca from the Portstewart dunes, collected in 1932-3.

By the President : An extensive exhibit of specimens, charts, etc., to illustrate his address.

By Mr. J. R. le B. Tomlin : All the known species of *Anostoma* ; *Epitonium magnificum* Sow. and *E. varicostatum* Lam. ; *Recluzia lutea* Bennet, *R. hargravesi* Cox, and *R. rollandiana* Récluz ; a number of rare species of *Tropidophora*, including *formosa* Sow., *vexillum* Sow., *denansi* Mab., *deliciosa* Fér., *deburghiae* Reeve, *belairi* Petit, and the type of *carnicolor* Ancey.

By Lt.-Col. Peile : The radula of *Volva volva* (L.), from the Straits of Malacca, and for comparison that of *Cypræa lynx* L. from Mombasa.

By Mr. G. L. Wilkins : Models of *Vermetus gigas* Gray, *Oliva scripta* Lam., *Olivancillaria*, *Terebra oculata* Lam. and *tigrina* Dh., *Murex tenuispina* Lam. and *palmarosae* Lam., *Strombus vittatus* L., *Arion ater* L., *Helix pomatia* L., *Geomalacus*, *Pila canaliculata* Lam., *Planorbis albus* Müll., and *Lambis bryonia* Gm. ; also a series of pink *Oliva* illustrating the effect of heat on colouration ; the specimens had been held for a few minutes in the flame of a methylated spirit lamp, probably achieving the same result as if lying for hours or days under a tropical sun. Heat does not seem to affect the polish, but slight cracks may appear which close up when cold. It is not suggested that all colour-vars. in *Oliva* are due to heat, but undoubtedly many of the pink specimens one sees have been thus produced.

By Mr. F. Taylor : Selection of British non-marine shells to show the possibilities of cleaning ; also their eggs and young to show specific development ; also a series of *Valvata macrostoma*, *Amnicola taylori*, *Planorbis dilatatus*, and others ; also sinistral examples of *H. aspersa*, *H. pomatia*, and *Oxychilus lucidus*—the two last from Coulsdon, Surrey.

ANNUAL REPORT.

This is the Fifty-Eighth Annual Report of the Society. During the last year we have lost three members by death, two by resignation, and three have been struck off the list through non-payment of arrears. Eight new members have been elected. The membership at present stands at 222, including the five Honorary Members.

The members lost by death are the Rev. S. Spencer Pearce, W. James Wintle, and Dr. R. F. Scharff.

Six ordinary meetings have been held at the Manchester Museum. On 11th November a joint meeting with the Yorkshire Branch was held at Leeds, and many interesting exhibits were shown. On 7th April a similar joint meeting was held at Manchester, and again there was a good display of specimens. In addition the members had the advantage of seeing some of the reserve collections in the Manchester Museum, under the guidance of the Hon. Secretary.

Twelve papers and notes have been communicated to the Society during the year, and several have since appeared in the *Journal*.

Three numbers of the *Journal* have been issued since the last Annual Meeting, viz. Vol. 19, No. 11, December, 1933 (received 12/12/33), with 32 pages of text (including Index) and 1 plate : this completes Vol. 19 ; Vol. 20, No. 1, 18th May, 1934, with 32 pages of text and 11 text-figures ; and Vol. 20, No. 2, 17th August, 1934, with 32 pages of text, 1 plate, and 7 text-figures. In addition a separate List of Members has been issued.

Additions to the Library have been received from Messrs. J. R. le B. Tomlin, G. C. Spence, J. F. Musham, R. J. Welch, A. K. Lawson, H. O. N. Shaw, J. R. M. Bergenhayn, C. F. Davidson, T. K. Chamberlain, H. H. Bloomer, H. Schlesch, J. A. Grieg, Dr. A. E. Boycott, and Miss Van Benthem Jutting. At the Annual Meeting last year Mr. J. E. Cooper presented to the Library the following books : Bound copy of *Histoire Naturelle des Mollusques Terrestres et Fluviatiles de la France*, by J. P. R. Draparnaud, also Complément, by A. L. G. Michaud, containing the bookplate of John Gwyn Jeffreys ; bound copy of *Index Testaceologicus*, 1818, by W. Wood, with bookplate and autograph of John Gwyn Jeffreys.

Additions to the Cabinet have been received from Mr. H. Schlesch and Dr. H. E. Quick (voucher specimens of *Succinea arenaria* B-Ch., from Tipperary, N.).

RECORDER'S REPORT (Non-Marine Mollusca).

Since the last report (Vol. XX, p. 27) thirty-three new records have been authenticated for the census.

Devon S. (3) : *Physa heterostropha* (nursery garden : A. E. Ellis).

Dorset (9) : *Milax sowerbii* (H. H. Bloomer).

Sussex W. (13) : *Testacella maugei*, *Sphaerium rivicola* (A. G. Stubbs).

Kent W. (16) : *Cochlicella barbara* (J. P. T. Burchell), *Pisidium milium* (L. B. Langmead).

Brecon (42) : *Milax sowerbii*, *M. gracilis* (A. E. Boycott).

Radnor (43) : *Pisidium pulchellum* (A. E. Boycott).

Pembroke (45) : *Sphyradium edentulum* (H. E. Quick).

Cheshire (58) : *Neritina fluviatilis* (W. H. Davies).

York N.W. (65) : *Paludestrina jenkinsi* (C. Allen).

Durham (66): *Vallonia pulchella*, *V. excentrica* (J. R. Crawford), *Paludestrina stagnalis* (E. P. Blackburn).

Northumberland S. (67): *Vallonia excentrica* (W. Philipson), *Vertigo substriata* (E. P. Blackburn).

Northumberland N. (68): *Vallonia pulchella* (G. W. Temperley), *Azeca tridens* (A. M. Oliver), *Planorbis nautilus*, *Pl. contortus* (W. Philipson), *Bithinia tentaculata* (E. P. Blackburn), *Acme lineata* (K. B. Blackburn).

Berwick (81): *Pisidium amnicum*, *P. lilljeborgii*, *P. milium*, *P. nitidum*, *P. obtusale*, *P. subtruncatum* (D. K. Kevan).

Haddington (82): *Pisidium henslowanum* (D. K. Kevan).

Queen's County (130): *Margaritana margaritifera* (R. A. Phillips).

Tipperary N. (143): *Succinea arenaria* (R. A. Phillips).

ANNUAL REPORT OF THE YORKSHIRE CONCHOLOGICAL SOCIETY.

We welcome Mr. K. G. Howell, of Leeds, to the Presidential Chair this year and up to the time of writing eight meetings have been held. The opening meeting was devoted to general exhibits and short papers by Mrs. E. M. Morehouse and Messrs. Firth, North, Armstrong, and Howell. In February Mr. J. C. North lectured upon the land shells of Malta, illustrating his remarks by many fine examples from his collection. The March meeting was of special interest, being the occasion of the Presidential Address. In April we visited Manchester, joining forces with the Parent Society.

Four excursions have been made during the summer, which, from a record point of view, were not very productive, the weather being on the whole too dry for any quantity of snails. The freshwater species seem to have been similarly affected, possibly owing to last year's exceptionally dry season, which caused many streams and the smaller rivers to dry up completely and so drastically reduced the larger rivers. Excursions were made to King Lane Pond, Leeds, Acomb Brick Ponds, York, Bramham, near Leeds, and Bentley, near Doncaster, from May to August.

The 38th Annual Meeting and two Ordinary Meetings will complete our activities for the year.

Membership has dropped a little and now stands at 28.

JOHN R. DIBB,
Hon. Secretary.

ANNUAL REPORT OF THE LONDON BRANCH.

The usual nine meetings have been held at the Cripplegate Institute, Golden Lane, E.C. 1, with fairly good attendance in spite of a certain amount of sickness. During the summer the Branch suffered a severe loss with the death of Mr. W. James Wintle, F.Z.S., who had been a staunch supporter for many years, and had occupied the Chair on many occasions. Although failing health had prevented him from attending regularly of late, his absence from future meetings will be greatly felt.

Several particularly interesting items were included in the 1933-4 syllabus. On the 12th March and 9th April the President, Mr. A. S. Kennard, read notes on "Pioneers in British Conchology", dividing the subject into two sections—Pre-Linnæan and Post-Linnæan, illustrating his remarks with examples from contemporary literature, some of which were extremely rare and curious. "Gems of my Collection," on 11th June, proved attractive, an unusually fine selection of specimens being shown, and the members giving short descriptions of their own particular "gems" with their reasons for so calling them.

Thanks are due to Mr. J. E. Cooper for regularly supplying notes throughout the year describing the marine genera down for discussion at

each meeting, and to Lieut.-Col. A. J. Peile, who has continued his notes on the foreign Operculates.

Altogether the Branch has had a good year, but it is still desirable that the membership should be substantially increased. A syllabus for 1934-5 is now in circulation. The meetings will be held at the Cripplegate Institute on the third Monday in each month, commencing 15th October, 1934.

GUY L. WILKINS,
Hon. Secretary.

621st Meeting, joint with the Yorkshire Conchological Society, held at Leeds, 10th November, 1934.

Mr. G. C. Spence in the chair.

Papers Read.

"Mollusca of the Ponds on the Downs in the Eastbourne District," by George Shrubsole.

"Self-fertilization in *Planorbis corneus* var. *albina* (Moq.)," by Chas. Allen.

Mr. Spence gave an interesting talk on *Urocoptis* and exhibited many species from his collection.

Exhibits.

By Mr. J. R. Dibb: *Clausilia cravenensis* from Addingham, Yorks; *Solen ensis* (9 in. long), from Port Erin, Isle of Man.

By Mr. J. F. Musham: Very large form of *Cypræa cervus* (7 by 4 in.). Also a collection of rare shells from a deposit at Broughton, Brigg, Lincolnshire, including *Acme lineata* and its monstr. *sinistrorsum*, *Vertigo antivertigo*, *Vertigo pusilla*, *Vertigo moulinsiana*, *Vertigo alpestris*, *Vertigo angustior*, *Vertigo genesii*, *Lauria anglica*, *Ena montana*, *Goniodiscus ruderatus*, and *Acanthinula lamellata*.

By Mr. K. Howell: A number of slugs from Adel, Yorks, including *Milax gracilis*, *Arion circumscriptus* and *hortensis*, *Agriolimax agrestis* var. *reticulata* and var. *nigra*. Also *Limax flavus* from Headingley, *Arion intermedius* from Wyke, *Limax cinereoniger* from Saw Woods, Thorner, *L. maximus* v. *sylvaticus* from Kirk Smeaton, and *Testacella scutulum* from Doncaster.

By Mr. H. L. Armstrong: Large selection of *Liguus* from Florida and Cuba; also *Blaesospira echinus* from Vinales, W. Cuba.

By Mr. C. H. Moore: *Ancylus* showing size and thickness from many localities.

By Mrs. Morehouse: Large series of *Bulimus* and *Bulimulus*.

622nd Meeting, held at the Manchester Museum, 8th December, 1934.

Mr. G. C. Spence in the chair.

Candidate Proposed for Membership.

Major C. J. F. Bensley, R.A., c/o Lloyds Bank, Cox's Branch, Pall Mall, S.W. 1. (Introduced by Lt.-Col. A. J. Peile and A. T. Hopwood.)

Members Deceased.

Rev. Dr. A. H. Cooke and G. C. Leman.

Resignations.

Rev. Dr. G. H. Carpenter and W. F. Webb.

Exhibits.

By Mr. C. H. Moore: Japanese shells.

By Mr. A. K. Lawson: Valves of *Pecten tigrinus* (Müll.) taken from stomach of flounder (Dundee, 1921): over 100 valves were found in one fish.

By Mr. G. C. Spence: *Holospira* and *Epirobia*.

623rd Meeting, held at the Manchester Museum, 12th January, 1935.

Mr. G. C. Spence in the chair.

Election of New Member.

Major C. J. F. Bensley.

Resignations.

S. G. Finch and C. H. Higgins.

Exhibits.

By Miss Fisher : Photographic print of feeding tracks of mollusca.
(On behalf of Dr. C. Hay Murray.)

By Mr. G. C. Spence : Series of Urocoptids.

By Mr. A. K. Lawson : Small pearls from pearl-mussel from R. Tay :
variation series of *Nucella lapillus*.

By Mr. C. H. Moore : *Solen siliqua*, 8 inches long, from Aberdeen and
Saltburn ; also series of small marines.

624th Meeting, held at the Manchester Museum, 9th February, 1935.

Mr. G. C. Spence in the chair.

Member Deceased.

Mrs. G. B. Longstaff.

Paper Read.

"The Cephalopods of the Yorkshire Coast," by J. A. Stevenson.

Exhibits.

By Mr. A. K. Lawson : *Cancellaria cancellata* from Algiers.

By Mr. F. Taylor : *Planorbis corneus* from Burgh Heath, Surrey ; also
very large examples of the same from Boynton Fish Ponds, near Scarborough.

By Mrs. Morehouse : Series of *Liguus* from Cuba ; also *Chondrothyra*.

By Mr. C. H. Moore : *Achatina achatina* from W.C. Africa.

There was a Special Exhibit of Past and Present Mollusca of the
Manchester District.

625th Meeting, held at the Manchester Museum, 9th March, 1935.

Mr. G. C. Spence in the chair.

Member Deceased.

Dr. E. W. Bowell.

Paper Read.

"Notes on the Snails of the Mullet, W. Mayo," by C. Oldham.

Exhibits.

By Miss N. Fisher : Imbricated variety of *Nucella lapillus* (L.) from
Trearthen Bay, Anglesey (1934), and from Mussel-beds, Marino, Co.
Down (1935).

By Mr. G. C. Spence : *Pachnodus*, etc., from South and Central Africa.

The Special Exhibit was *Cypræa*.

626th Meeting, joint with the Yorkshire Conchological Society, held at
the Manchester Museum, 6th April, 1935.

The President, Mr. J. Davy Dean, in the chair. Nine persons present.
Apologies were read from several members.

Address by President.

The President delivered a short address on "Historical or Type-
Localities of British Mollusca", and a cordial vote of thanks was passed
unanimously.

Exhibits.

By Mr. G. C. Spence : South African *Achatina*.

By Mrs. Morehouse : Locality sets of *Helix nemoralis* L. and *Helicella virgata* (Da Costa) ; also *Acmaea testudinalis* (Müller) from Scarborough, and other marine shells.

By Mr. C. H. Moore : Non-Marine Mollusca from the districts around Stalybridge and Grange-over-Sands.

By Mr. F. Taylor : Large collection of Lancashire Non-Marine Mollusca.

By Dr. J. W. Jackson : Local Non-Marine Mollusca and Habitat-photographs.

By Miss N. Fisher, Mr. W. Fowler, and Liverpool Public Museum : *Nucella lapillus* var. *imbricata* Lamarck. Only known locality for true var. *imbricata* is off Rhoscollyn Bay, Anglesey, where it was discovered by McAndrew. (a) Var. : One of McAndrew's original specimens. Dredged "on an oyster-bed 4-7 fms." See Jeff., *B.C.*, vol. 4, p. 277. Ex. coll. Liverpool Museum. (b) Var. : Specimens dredged in 11-12 fms., same place, by W. Fowler, 1934. They occurred singly, dotted about on a bottom of pure *Balan* ; nothing else came up in the dredge. Ex. coll. N. Fisher. (c) Normal "sheltered" : *N. lapillus*—"sheltered coast" form. Marino shore, Co. Down, Feb., 1935. Young usually imbricated, and small percentage of adults also. Ex. coll. N. Fisher. (d) Normal "exposed" : *N. lapillus*—"exposed coast" form. Idrigal Pt., N. of Vig, Skye, Sept., 1933. Coll. by Dr. C. Hay Murray. No trace of imbrication.

627th Meeting, held at the Manchester Museum, 11th May, 1935.

Mr. G. C. Spence in the chair.

Papers Read.

"*Vertigo genesii* Gredler in Central Ireland," by R. A. Phillips.

"Notes on and Description of a New Species of *Macrocallista*," by W. J. Clench and R. A. McLean.

"African Studies : *Edentulina* and *Gonaxis*," by W. J. Clench.

"Catalogue of *Latiaxis*," by J. R. le B. Tomlin.

Exhibits.

By Mr. G. C. Spence : *Cochlicella acuta* (Müller), vars. from Rye, etc. ; *Clavator* spp. from Madagascar.

By Mr. F. Taylor : *Pyramidula rotundata* (Müller), *Clausilia laminata* (Montagu), and white *Clausilia biplicata* (Montagu), from Purfleet ; *Helix hortensis* Müll., vars. and darts from Carshalton.

By Mrs. Morehouse : *Placostylus*.

By Mr. C. H. Moore : Series of *Bulla*.

By Mr. A. K. Lawson : Photograph of "Clam Shells" perforated for buttons.

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CONTENTS.

	PAGE
<i>Limnæa involuta</i> in W. Sutherland—C. OLDHAM	161
<i>Eastonia rugosa</i> and other Portuguese Moll.—H. C. WINCKWORTH and R. WINCKWORTH	162
<i>Crepidula formicata</i> in Schleswig and Denmark—H. SCHLESCH	163
A New <i>Albinaria</i> from Cyprus (with figs.)—J. R. le B. TOMLIN	164
Slug and Beetle—Id.	165
<i>Helicella acuta</i> inland—L. E. ADAMS	165
Fatal "Sting" by a Cone—T. IREDALE	166
<i>Pisidium vincentianum</i> in a Kentish Pleistocene Deposit—C. OLDHAM	167
The Marine Mollusca of Magilligan—N. FISHER	168
Type Localities of Brit. Mollusca—J. D. DEAN	176
Catalogue of Recent <i>Latiaxis</i> —J. R. le B. TOMLIN	180
Proceedings: Oct. 19, 1935 (Annual Meeting)	184
Two Editions of vol. i of <i>The Conchologist</i> —J. R. le B. TOMLIN and N. FISHER	192

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LIMNÆA INVOLUTA THOMPSON, IN WEST SUTHERLAND.

By CHAS. OLDHAM.

(Read before the Society, 19th October, 1935.)

ON 28th June and again on 2nd July, 1935, I visited Loch Fleodach Coire, a bare mountain tarn at about 1,300 feet in the wild country $2\frac{1}{2}$ miles north-east of Inchnadamph, where particularly near the outlet stream I found an involute *Limnæa* in some abundance, a form which hitherto has been observed only in South-West Ireland. The loch, in two parts connected by a short channel, has a total length of some 600 yards and a maximum width of about 400. The outlet stream falls steeply for 150 feet to a tarn known to the Inchnadamph anglers as the Fiddle Loch, and then steeply again for some 900 feet to Loch Assynt, which it enters south-east of the ruined castle of Ardvreck.

The water of Loch Fleodach Coire is deficient in lime ; its bed stony for the most part, but in places there is coarse sandy grit and in others peat. The only plants seen, and those sparingly, were *Potamogeton natans* and *Isoetes hystrix*. On the under side of the stones a sponge (*Spongilla lacustris*) was common. Apart from the *Limnæa* the only mollusc seen was *Pisidium lilljeborgii*. In the bright sunshine the *Limnæas* were crawling on the stones, and others were found beneath them, where there were many egg-capsules and newly hatched young. The capsules usually contained four or five eggs, but the number varied from two to ten.

In all the specimens collected the upper angle of the mouth was the highest part of the shell, and all were markedly involute ; indeed, except that the mouth was wider and the outer lip more rounded in consequence, they might have come from Lough Crincaum or one of the little loughs near Glengarriff. I failed to find any *Limnæa* in the Fiddle Loch, where, however, *Pisidium lilljeborgii* was abundant, and the snails found in Loch Assynt were just small *Limnæa pereger* with moderate spires.

Professor Boycott tells me that the anatomy of the Loch Fleodach Coire snails, like that of those in Loch Crincaum and the Glengarriff loughs, is that of *L. pereger*, to which species all these snails with involute spires should perhaps properly be referred, but for convenience of reference, although not from conviction, I have in this note retained Thompson's specific name *involuta*.

EASTONIA RUGOSA AND OTHER PORTUGUESE MOLLUSCA.

By H. C. WINCKWORTH and R. WINCKWORTH.

(Read before the Society, 2nd November, 1935.)

PRAIA DA ROCHA is a small plage in the township of Portimão, on the southern shore of Algarve, about 20 miles from Cape St. Vincent, which we visited during the spring tides of 12th to 15th September this year. The foreshore is a sandy beach with cliffs and stacks of a soft Miocene limestone containing many *Pecten* and other fossil shells: eroded reefs of this limestone extending for half a mile or so beyond a natural arch on the west of the plage proved to be the best collecting ground. We also explored the sands, which provided numerous live *Donax trunculus* L. and *Nassarius reticulatus* (L.), several species of Solenidæ, and many species of dead shells. *Macra corallina* (L.) is abundant on these sands; it varies considerably in colour and to some extent in shape, and there seems little doubt that Reeve's *Macra epidermia*,¹ described as from Portugal, is only an abnormal example of this species.

Valves of *Panopea glycymeris* (Born), up to 10 inches in length, were common in the sand at the mouth of the river on the east of Praia da Rocha, but we failed to find living examples; it presumably burrows in the sand somewhere near extreme low water. The difficulties, successfully overcome, in obtaining another large species of this genus, *P. australis* Sowerby, from Tigers' Bay in Angola (curiously said to be in Natal), are recorded by Valenciennes in his monograph on *Panopea*.²

Our most interesting result was the discovery of living *Eastonia rugosa* (Helbling). This species has been known, as a shell, for over 150 years, but its habitat has not been recorded. We found that it was a boring mollusc, burrowing in the limestone reef near low water in company with *Pholas dactylus* L. and *Barnea candida* (L.), though not very common; we saw, I suppose, over a hundred live *Pholas*, but only three living *Eastonia*, and three more complete shells in situ in their burrows. The siphons are large as well as long (the mean extension is about equal to the length of the shell) and encased in a brown sheath like those of *Mya truncata* L. The recorded distribution is mainly Atlantic, from Portugal to West Africa and the Canaries, though there are also Western

¹ *Conch. Icon.*, vol. 8, *Macra*, fig. 11.

² *Arch. Muséum (Paris)*, vol. 1, p. 1 (1839).

Mediterranean records (Alicante, Algeria) : the principal references in literature have been given by Lamy.³

In the empty shells of *Eastonia* in each case we found *Ungulina rubra* (Roissy) living, another species whose range extends from Portugal to West Africa, recalling the somewhat similar habitat of our English *Sphenia* in empty *Hiatella* burrows.

Other rock burrowing species encountered were *Lithophaga aristata* (Dillwyn), *Paphia saxatilis* (Fleuriau), *Petricola lithophaga* (Retzius), and *Irus irus* (L.), all plentiful, and a few *Hiatella pholadis* (L.).

Another interesting find was *Pseudopythina macandrewi* (Fischer) alive in a rock pool. This seems a rare species, though Hidalgo gives several Spanish records as from extreme low water ; there are deep water records from off Portugal and in the Bay of Biscay ; and it has been obtained under stones at low water in Brittany.⁴ For literature see footnote.⁵

Altogether we found eighty-eight species of mollusca, of which thirty-eight were taken or observed alive. It is not proposed to give a list of these as for the most part they are recorded by Nobre in his *Moluscos Marinhos de Portugal*,⁶ which gives detailed localities and illustrations of every species including nudibranchs. Another work that should be consulted on Portuguese mollusca is Hidalgo's *Fauna Malacológica de España, Portugal y los Baleares : Moluscos Testáceos Marinos*.⁷

³ *J. Conchyl.*, vol. 63, p. 386 (1917). See also Nobre, op. cit., p. 370.

⁴ *Trav. Sta. Biol. Roscoff.*, fasc. 3, p. 125 (1925).

⁵ Kobelt, *Prodromus*, p. 387 (1888) and references there given. Also Jeffreys, *Proc. Zool. Soc.*, 1881, p. 952 (1882) ; Monterosato, *Solarii*, p. 12 (1873) ; Locard, *Travailleur*, vol. 2, p. 303 (1898) ; and Hidalgo, op. cit., p. 574. It seems clear that the specific name should be *macandrewi*, and not *setosa* nor *caillati*.

⁶ *Instituto de Zoologia da Universidade do Porto*, 466 pp., 80 pl. (1932).

⁷ *Museo Nacional de Ciencias Naturales, Madrid*, part i, pp. 1-112 (1916) ; part ii, pp. 113-400 (1917) ; part iii, pp. 401-752 (1917).

Crepidula fornicata L. in Schleswig and in Denmark.—In my paper on the distribution of *Petricola pholadiformis* Lam. in *Arch. f. Molluskenkunde*, 1932, p. 151, I mentioned that *C. fornicata* L. might be expected to appear in Danish waters. At a recent meeting of the Danish Nat. Hist. Soc. Dr. R. Spärck reported that *C. fornicata* L. was observed at the oyster colonies in the Limfjord last year, imported with young oysters from Holland, and in the same way it has been imported into the colonies at Ellenbogenbank near List, Isle of Sylt, West Schleswig, having been collected there in August, 1934, by Dr. W. Ankel (*Natur und Volk*, April, 1935, p. 176).—H. SCHLESCH. (Read before the Society, 19th October, 1935.)

A NEW ALBINARIA FROM CYPRUS.

By J. R. LE B. TOMLIN.

(Read before the Society, 19th October, 1935.)

Albinaria greeni n.sp.

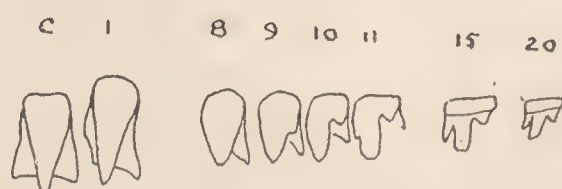
THIS shell is an addition to the very homogeneous little group of Cypriote *Albinaria*, of which *saxatilis* Pfeiffer is the commonest and most familiar species, and like *saxatilis* has white axial ribs on a ground-colour of the palest grey. It seems, however, to be most closely related to *avia* Charpentier, but larger in every way; the aperture of *greeni* is notably larger and subquadrate, not pyriform; its axial ribs are more regular, very much finer, blunter, and less prominent; it is extensively decollate when mature, losing from 6 to 8 whorls and being left with 6–7, whereas *avia* only loses about two.

The immature shell has a polished, bulbous protoconch of about a whorl and a half with extremely fine short axial striæ below suture extending across less than half the whorl; these striæ gradually lengthen on the succeeding deciduous whorls, but disappear on



Albinaria greeni. $\times 3$.

the adult; on the 3rd or 4th deciduous whorl minute white nodules appear irregularly just below the suture, and on succeeding whorls



Representative teeth of radula.

these nodules form the bases of the axial ribs, which on the last deciduous whorl are about half as numerous as on the first permanent one.

Dimensions of holotype :—

L. 13 : diam. max. 4 mm.

Aperture 3×3 mm.

Hab.—Hills between Limassol and Paphos at an altitude of ca. 800 feet, rather common.

This species forms one of a very extensive collection of land shells made by Mr. Ernest E. Green, the well-known entomologist and authority on Coccidæ, in the course of a winter in Cyprus.

The combination of entomology and conchology in fieldwork is often a happy and a fruitful one, and Mr. Green seems to have found it particularly so, as there are very few of the recorded species of mollusca that he has missed.

I am indebted once more to Lieut.-Colonel A. J. Peile for figures of representative teeth on the radula.

The specimen from which the figures are taken is in the British Museum collection; it has ninety formed rows of teeth with formula 24—1—24; the admedians change shape gradually from Nos. 1 to 8; an ectocone appears at No. 9, and an endocone at No. 11; the marginals then diminish in size; the three outermost lines are rudimentary.

Slug and Beetle.—One evening recently my wife called my attention in the garden to a large ground beetle carrying off a small slug (*Agriolimax agrestis*) in its mandibles. The beetle proved to be *Carabus violaceus* L.—the same species that was observed by Mr. C. H. Moore attacking a slug, as recorded on page 85 of this volume, only in that case the slug was *Arion hortensis*. The *Carabus* was travelling fast and holding its prey well up in the air to avoid obstacles.—J. R. LE B. TOMLIN. (*Read before the Society, 19th October, 1935.*)

Helicella acuta, an inland locality. The existence of a thriving colony of *H. acuta* in the centre of the Isle of Wight, 5 miles from the sea, is noteworthy as unusual in Great Britain.—LIONEL E. ADAMS. (*Read before the Society, 19th October, 1935.*)

FATAL "STING" BY A CONE.

By TOM IREDALE.

(Read before the Society, 19th October, 1935.)

ALTHOUGH there have been many reports of attacks by Cones from the outlying islands of the Pacific Ocean, there has never previously been a case in Australia.

On 25th June, 1935, a young man in his twenties, Charles Garbutt, was fatally stung by a Cone, almost definitely *Conus textile*, at Hayman Island, one of the Whitsunday Group of Islands, Queensland. Apparently he was handling it when "a spike" came out and pierced his hand. He did not complain of pain until later, when he said his sight was failing and that he had a burning sensation round the mouth. He grew steadily worse and died while being taken to hospital. This is the first fatal case in Australia and there do not seem to have been many others elsewhere.

In the *Australasian Medical Gazette* for September, 1912, Dr. J. B. Cleland gave an account of the bites of shellfish of the genus *Conus*, from a MS. note given him by Hedley. The well-known cases by A. Adams, Bennett, Crosse and Marie, Montrouzier, and Garrett were cited and an additional case of a European lady bitten by a *Conus geographus* in Fiji in June, 1901, was detailed. The shell was sent by Dr. B. G. Corney from Levuka, Fiji, with a full medical account of symptoms and treatment, to Dr. A. H. Hallen, who handed the shell to the Australian Museum where it is still preserved. The Cones responsible for attack up to the present are :—

Conus aulicus : Moluccas (Sir E. Belcher *vide* A. Adams).

Conus geographus : New Britain (Cox) ; Fiji (Cleland).

Conus marmoreus : Loyalty Islands (Montrouzier).

Conus textile : New Hebrides (Bennett) ; New Caledonia (Crosse and Marie).

Conus tulipa : New Caledonia (Crosse and Marie) ; Paumotus (Garrett).

It is probable that all Cones are more or less poisonous, but generally the animal is sluggish and does not move much.

Conus textile is not uncommon on the Great Barrier Reef, and many have been collected alive without injury, but more care will be taken in the future.

PISIDIUM VINCENTIANUM IN A KENTISH PLEISTOCENE DEPOSIT.

By CHAS. OLDHAM.

(Read before the Society, 19th October, 1935.)

A FEW weeks ago Mr. J. P. T. Burchell kindly sent for my inspection a gathering of Pisidia from a Pleistocene deposit at Sittingbourne, in which Mr. A. S. Kennard tells me the associated species were *Planorbis lævis*, *Limnæa pereger*, *L. truncatula*, *Sphærium corneum*, and a few land shells. Some of the Pisidia resembled in certain characters this or that recent species, but among them were others that I could not with confidence refer to any; and it may be that the gathering includes species other than those I could identify with certainty. Many of the shells may be assigned definitely, and many more probably, to *P. cinereum*. A considerable number is, I believe, an inappendiculate form of *P. henslowanum*, and there are a few *P. amnicum* and *P. subtruncatum*. Of more interest, perhaps, is the occurrence of *P. vincentianum*, of which there are a good many quite characteristic valves.

In Britain, so far as I know, *P. vincentianum* has been found only in an early Holocene deposit near Killough, Co. Down, where it was recognized by Mr. A. W. Stelfox (*Proc. Roy. Irish Acad.*, xxxix, Sect. B, No. 1, p. 10); and the purpose of this note is to call attention to its occurrence in the Pleistocene of South-East England, where, despite the characters which separate it so clearly from all other British Pisidia, it has probably been overlooked. It was described and figured in 1913 by B. B. Woodward (*Cat. Brit. Species of Pisidium in Brit. Mus.*) from the Pleistocene at Soignies, Belgium. He emphasizes the unusual character of the hinge-plate and the unique position of the ligament-pit, which, owing to the central part of the hinge-plate being bent downwards and backwards towards the umbo, is virtually visible only when viewed from across the ventral margin of the shell.

THE MARINE MOLLUSCA OF MAGILLIGAN. CO. DERRY.

By NORA FISHER.

MAGILLIGAN has long been famous for the variety and abundance of the shells thrown up on its strand, but hitherto no detailed list has been published. The following list must be regarded as tentative only, for no dredging has been done, and my own collecting has been limited to four half-days' work on the shore. Nevertheless, 138 species were obtained, to which number must be added a further twenty-four species recorded by other observers.

The district of Magilligan forms a triangle of flat land with the apex projecting across the mouth of Lough Foyle towards Inishowen, Co. Donegal. On the north it is washed by the Atlantic and on the west by Lough Foyle. Inland the old coastline is clearly seen in the magnificent range of old sea-cliffs which extend across the base of the Magilligan triangle from Downhill on the east and culminate in Benevenagh on the west. The north shore is an unbroken stretch of sand which runs eastward from Magilligan Point for nearly 7 miles to Downhill, where the old sea-cliff descends to the sea margin. This shore, especially near the Umbra, is by far the more productive of species; drifts of small shells, mixed with *Terebella* tubes, sometimes line the shore for miles.

About Downhill are a number of isolated rocks jutting out of the sandy shore and at the railway tunnel the shore is rocky and precipitous. This small area provides the only rocky part of the entire Magilligan coastline.

The Lough Foyle shore is not nearly so prolific; it is uniformly of muddy sand, and the shells cast up are usually much worn, and species few.

A large brackish pool lies in the dunes between the Martello Tower and the sea at Magilligan Point, a shallow channel, now (June, 1935) dry, connecting it with the sea. Presumably during autumn and winter the sea reaches the pool, as it tasted slightly salt. When visited it had shrunk considerably below its usual level, judging from the line of débris around the margin. It contained a few flounders, about 6 inches long, many dead juvenile specimens of *Cardium edule* L. and *Mya arenaria* L., half-buried in the mud at the edge, and in the deeper water were large colonies of adult *Mytilus edulis* L., but all dead. Perhaps the pool was colonized during the autumn, and only the flounders had been able to survive until June? Under favourable conditions *Mytilus edulis* grows with extraordinary rapidity, so the size of the mussels does not negative this suggestion. No *Hydrobiæ* were noted, but they may have been buried in the mud, and I had not time to search for

them. The pool shelved very steeply in one place, to a depth of apparently about 8–10 feet. It is intended to investigate the fauna and conditions of this pool in detail.

There has been very little work on the molluscan fauna of the district; the earliest Magilligan record is that of *Pinna*, mentioned in a letter from the Rev. Robert Innes to Dr. Nicholson, Bishop of Derry, written in 1725 (1)¹. Miss H. Galwey (2), in 1888 published a scanty list of species, and there are many Magilligan records in Thompson (3), mainly supplied by G. C. Hyndman. Hart (4), in his paper on the marine mollusca of Donegal and Dublin, incidentally added a few species to the Magilligan list, and Praeger (5) also supplied a few species. Finally Nichols (6) in 1900 published a number of additional species mainly from Thompson's unpublished MSS.

The following list has been compiled from (a) material collected by members of the Route Naturalists' Field Club, Mr. R. J. Welch, and myself in May, 1932; (b) material collected by Mr. Eric Young and myself in May, 1933; and (c) several additional species collected by the Rev. W. J. Gregg and Noel Gregg and sent to me for identification. Also Mr. Young kindly allowed me to look over his collection, in which were a few Magilligan species not otherwise noted. Some additional species were obtained in May, 1935, by R. MacDonald and myself.

In every case, unless otherwise mentioned, dead but fresh shells were found; the scarcity of living specimens is remarkable.

The nomenclature and arrangement are those of Winckworth's List (7):—

Emarginula reticulata mulleri F. & H. In drift, plentiful.

Diodora apertura (Mont.). Moderately common.

Patella vulgata L. Living on Downhill rocks.

Patella athletica Bean. Recorded by Galwey (2).

Patina pellucida (L.). Many in drift, 1935.

Patina lævis (Pennant). Common.

Patelloida virginea (Müller). Common in drift.

Calliostoma zizyphinum conuloide (Lam.). Frequent, also var. *lyonsi*.

Gibbula magus tuberculata (da C.). Not common.

Gibbula tumida (Mont.). Moderately common.

Gibbula cineraria (L.).

Cantharidus montagui (W. Wood). Three shells.

Tricolia pullus pictus (da C.). Frequent.

¹ The numbers in parentheses refer to Bibliography at end of article.

Lacuna vincta (Mont.). Plentiful.

Lacuna crassior (Mont.). Two shells.

Lacuna parva (da C.). Fairly common in drift.

Lacuna pallidula (da C.). Sparingly in drift.

Littorina littorea (L.). Not common.

Littorina saxatilis saxatilis (Olivi). An attractive little striped and chequered form is frequent in drift.

Littorina saxatilis jugosa (Mont.). Living, abundant, on the exposed rocks at Downhill railway tunnel.

Littorina neritoides petræa (Mont.). Living, plentiful on rocks at Downhill.

[*Hydrobia ulvæ* Pennant. No doubt lives on the Lough Foyle mud-flats, but I did not actually observe it there on my one visit to that part of the shore, nor did I ever find it in drift on the north shore. Farther up Lough Foyle, on the mud-flats round Eglinton, it is very abundant, and probably lives all along the Lough Foyle border of Magilligan.]

Potamopyrgus jenkinsi Smith. I have included this freshwater species as its empty but beautifully fresh and clean shells occur plentifully in shell-drift from the Umbra. The shells are of a uniform clear golden-brown colour. Mr. A. W. Stelfox suggests that they have been washed from the Bann River by floods. Sometimes other land and freshwater species occur in the drift; *Vallonia* is the most frequent.

Cingula proxima (F. & H.). Recorded by Thompson (3). Doubtful; a critical species.

Cingula semicostata (Mont.). Abundant.

Cingula semistriata (Mont.). Two, in drift, 7-5-1935.

Cingula cingillus (Mont.). One.

Alvania crassa (Kanmacher). Frequent in drift.

Alvania cancellata (da C.). Scarce in drift.

Alvania punctura (Mont.). Scarce, in drift.

Rissoa parva (da C.). Plentiful, both the ribbed and smooth forms.

Rissoa membranacea (J. Adams). Scarce, in drift.

Tornus subcarinatus (Mont.). Two, in drift, May, 1935.

Skeneopsis planorbis (Mont.). Five, in drift, 1932 and 1935.

Turritella communis Risso.

Bittium reticulatum (da C.). Moderately common.

Cerithiopsis tubercularis (Mont.). Scarce, in drift.

Triphora perversa (L.). Two fresh shells.

Clathrus clathrus (L.). Fairly common.

Clathrus turtonis (Turton). Recorded by Nichols (6).

Clathrus trevelyanus (Johnston). Three.

Clathrus clathratulus (Kanmacher). Not uncommon, in drift.

Janthina britannica F. & H. Gregg obtained several specimens in 1933.

Eulima trifasciata (J. Adams). One (Gregg). Another, broken, in drift.

Balcis alba (da C.). Several.

Chrysallida indistincta (Mont.). One (Gregg). Three more, in drift, 7-5-1935.

Chrysallida decussata (Mont.). One (Gregg). An addition to the recent fauna of North-East Ireland. Nichols's records are probably early post-glacial (6, p. 552).

Chrysallida spiralis (Mont.). Several, in drift.

Menestho dolioliformis (Jeffreys). One, in drift, 7-5-1935. An addition to the recent fauna of North-East Ireland. The specimen is now in the Public Museums, Liverpool.

Odostomia scalaris MacGillivray. A few (Gregg). Eight, in drift, 7-5-1935.

Turbonilla elegantissima (Mont.). Several.

Capulus ungaricus (L.). Common, of all sizes.

Aporrhais pespelicani quadrifidus da Costa. Frequent, of all sizes.

Natica catena (da C.). Frequent, and often thrown up alive. The spawn is also common.

Velutina velutina (Müller). Fairly plentiful in drift.

Lamellaria perspicua (L.). A few.

Erato voluta (Mont.). Two (Gregg). Two more, drift, 1933.

Trivia monacha (da C.).

Trivia arctica (Mont.). Both species of *Trivia* are frequent at Magilligan, and *arctica* appears to be the more plentiful. Out of a large boxful of specimens sent me by Young, numbering altogether 645, 405 specimens were *arctica*, and the remaining 240 *monacha*. Dr. Lebour in her paper on the British species of *Trivia* (8) states (p. 483) that the shell of *monacha* is usually larger than that of *arctica*, but in the Magilligan specimens I cannot see any difference between the two species. The occasional very large specimens which occur are usually *monacha* however.

Simnia patula (Pennant). Several specimens taken during 1932 and 1933. It is a rare species in North-East Ireland.

Trophon truncatus (Ström). One very worn specimen, named by Winckworth.

Trophon muricatus (Mont.). Recorded by Nichols (6) as having been taken alive.

Nucella lapillus (L.). Frequent. A large, very solid form with a short spire and very wide mouth lives on isolated rocks near Downhill tunnel.

Ocenebra erinacea (L.). Frequent, some of the specimens very fresh-looking.

Colus gracilis (da C.). Frequent.

Neptunea antiqua (L.). Common.

Buccinum undatum undatum L. Common.

Nassarius incrassatus (Ström). Commoner than *N. reticulatus*.

Nassarius reticulatus (L.).

Hædropleura septangularis (Mont.). Two fine specimens.

Lora turricula turricula (Mont.). One (Gregg).

Lora turricula rosea (Lovén). One fine specimen (Gregg).

Lora rufa rufa (Mont.). Scarce.

Mangelia coarctata (Forbes). Several (Gregg).

Mangelia nebula (Mont.). Three, verified by Winckworth.

Philbertia linearis (Mont.). Fairly frequent.

Acteon tornatilis (L.). Frequent.

Retusa retusa (Maton & Rackett). One, 7-5-1935.

Retusa alba (Kanmacher). Four, in drift, 1932. Eight more, 7-5-1935.

Diaphana minuta Brown. One, in drift.

Cylichna cylindracea (Pennant). Plentiful, of all sizes.

Tricla lignaria brownii Leach. Frequent.

Hermania catena (Mont.). Fairly frequent, in drift.

Acteonia cocksii (A. & H.). Plentiful in a large shallow pool at high-water mark, Downhill, at mouth of railway tunnel, 7-5-1935. Associated with *Cladophora utriculosa*, Kutz., and was found only on this alga or else crawling on the bare sandy floor of the pool. *Enteromorpha* and *Ulva*, and one or two small brown-red algæ also occurred in the pool. I am indebted to Dr. Helen Blackler for the identification of the *Cladophora*. When *Acteonia* was searched for on 10-6-1935 in the same pool not a single specimen could be found. This species is another addition to the fauna of North-East Ireland.

Leucopepla bidentata (Mont.). One (Gregg). The first record for Co. Derry.

Nucula nucleus (L.). Valves frequent.

Glycymeris glycymeris (L.). Very plentiful; valves especially so on the Lough Foyle side of the Point, May, 1935.

Arca tetragona britannica Reeve. Valves plentiful.

Anomia ephippium L. Valves frequent.

Mytilus edulis L. Living, abundant, on isolated rocks at Downhill.

Modiolus modiolus (L.).

Musculus discors (L.). Two valves, in drift, 7-5-1935.

Musculus marmoratus (Forbes). Five valves.

Ostrea edulis L. Odd valves only.

Pinna fragilis Pennant. Recorded by Innes in 1735 (1), and also by Portlock in 1843.

Pecten maximus (L.). Valves not common.

Chlamys varia (L.).

Chlamys distorta (da C.). Valves frequent.

Chlamys opercularis (L.).

Chlamys tigerina tigerina (Müller). Two valves, 7-5-1935.

Chlamys tigerina obsoleta (Pennant). Five valves, 1932 and 1935.

Chlamys septemradiata (Müller). A single valve recorded by Hart (4) and Thompson (3) mentions specimens supposed to be from Lough Foyle.

Lima hians hians (Gm.). "Coast of Derry," recorded by Nichols (6).

Astarte triangularis (Mont.). Valves very plentiful.

Thyasira flexuosa (Mont.). Two imperfect valves.

Myrtea spinifera (Mont.). Recorded by Nichols (6).

Phacoides borealis (L.).

Kellia suborbicularis (Mont.). Sparingly, in drift.

Lasæa rubra (Mont.). Valves fairly common, but not so frequent as those of the next species.

Turtonia minuta (Fab.). Valves very plentiful.

Lepton nitidum Turton. A few in drift (Gregg).

Montacuta ferruginosa (Mont.). Valves fairly common.

Mysella bidentata (Mont.). Valves plentiful, and two perfect specimens in drift, 7-5-1935.

Cyprina islandica (L.). Very plentiful, and often thrown up alive.

Glossus humanus (L.). Recorded by Frazer (9).

Cardium echinatum L. Sometimes thrown up alive.

Cardium ovale Sow. One valve (Gregg.).

Cardium exiguum Gm.

Cardium edule L.

Cardium edule lamarckii Reeve. Recorded by Galwey (2).

Cardium crassum Gm. Recorded by Galwey (2).

Dosinia exoleta (L.). Recorded by Galwey (2).

Dosinia lupinus lincta (Mont.). Very plentiful, and often thrown up alive.

Gafrarium minimum (Mont.). A few valves.

Venus casina L.

Venus ovata (Pennant). Plentiful.

Venus fasciata (da C.).

Venus striatula (da C.). Frequent and sometimes thrown up alive.

Small living specimens were fairly abundant, 7-5-1935.

Paphia rhomboides (Pennant). Very common, and often found living.

Paphia pullastra (Mont.). One specimen, and a valve in Eric Young's collection. Much scarcer than *P. rhomboides* in the Magilligan district.

Mysia undata (Pennant). Recorded by Galwey (2).

Donax vittatus (da C.). Frequent. Regarding this species Thompson (3) says (pp. 343-4): "Plentiful, close to low-water mark at Magilligan, where it is collected by the people for food."

Tellina squalida Mont. Recorded by Nichols (6), and I have seen valves collected by Miss Kathleen Maxwell at Downhill strand.

Tellina tenuis da Costa. Several fresh specimens.

Tellina fabula Gm. Appears to be rather scarce.

Tellina pygmæa Lovén. Four valves (Gregg). Two more, 7-5-1935.

Tellina crassa Pennant. Recorded by Nichols (6).

Macoma balthica (L.).

Abra alba (W. Wood). Fairly common in drift.

Abra prismatica (Mont.). Moderately common in drift.

Gari fervensis (Gm.). One perfect specimen.

Gari depressa (Pennant). A single valve recorded by Nichols (6).

Gari tellinella (Lam.). Recorded by Hart (4).

Solecurtus scopula (Turton). Recorded by Nichols (6).

Pharus legumen major Bucquoy, Dautzenberg, and Dollfus.
Recorded by Nichols (6).

Ensis ensis (L.).

Ensis siliqua (L.). Abundant.

Solen marginatus Mont. Recorded by Forbes and Hanley (10).

Macra corallina cinerea Mont. Common, sometimes thrown up alive.

Spisula elliptica (Brown).

Spisula solida (L.). Fine living specimens thrown up plentifully,
7-5-1935.

Spisula subtruncata (da Costa). Small fresh-looking valves scarce.
One live juvenile shell measuring 12×12 mm., 7-5-1935.

Lutraria lutraria (L.). Shells very abundant, especially just at Magilligan Point.

Lutraria magna (da C.). Recorded by Thompson (3) as *L. hians* Fleming.

Mya truncata L. Rather scarce.

Mya arenaria L. Not noted, except the dead young in the brackish pool.

Aloidis gibba (Olivi).

Hiatella arctica (L.). Valves sparingly.

Hiatella gallicana (Lam.). Valves occur sparingly in drift.

Barnea candida (L.). One fragment of a valve, 7-5-1935.

Zirphæa crispata (L.). A few large old valves, worn, May, 1932.

Teredo navalis L. Recorded by Galwey (2).

Cochlodesma prætenue (Mont.). Recorded by Thompson (3) as *Anatina prætenuis*, as occurring "quite fresh" at Magilligan.

Thracia phaseolina (Lam.). Recorded by Hart (4).

Thracia villosiuscula (MacGillivray). One valve, in drift, 7-5-1935.

Lyonsia norwegica (Gm.). Recorded by Hart (4).

Sepia elegans Orbigny. Three dorsal plates found by G. C. Hyndman at Magilligan are recorded by Forbes and Hanley (10).

The following species recorded from Magilligan by Thompson (3) are erroneous :—

Rissoa Bryerea Mont. = *Rissoina bryerea* Mont. West Indian.

Donax denticulatus Linn. = West Indian.

Pectunculus pilosus Linn. = *Glycymeris pilosus*. *G. pilosus* is a Mediterranean species which does not occur in the British Isles. Probably *G. glycymeris* was the species really found.

Venus verrucosa Linn. "A young valve in Hyndman's collection." There is no such valve in Hyndman's collection now. Doubtless an error, as *V. verrucosa* is a southern species and does not now live in North-East Ireland.

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TYPE LOCALITIES OF BRITISH MOLLUSCA.

By J. DAVY DEAN, F.R.E.S.

(Read before the Society 6th April, 1935.)

THE first records of British non-marine mollusca are given by Kennard and Woodward in their *Synonymy of the British Non-marine Mollusca*. Thus on p. 4 we find that the well-known freshwater species *Theodoxus fluviatilis* (Linnæus) was first recorded as British by M. Lister (*Hist. Anim. Angl.*, p. 136). This reference gives us the following habitats—River Ouse at Fookforth and Clifton (probably a mile or two north-west of the City of York), River Wharfe and River Lune, near “Kerby-Launsdale”. Such localities are historical and, in this instance, date as far back as 1678, and specimens, if obtainable, should be so marked.

The information regarding records of British marine mollusca is more scattered and the locality is not always given. Thomas Pennant, who was the first author on British Mollusca to use the Linnean nomenclature, describes a number of species, many of which are without mention of locality. This was not so much carelessness as lack of appreciation of the importance of locality data. But of the species first described by Pennant, and as new to science, were two which are of interest, *Cultellus pellucidus*, from Red Wharf Bay, Anglesey, and *Hydrobia ulvæ* from Flintshire. These are understood as Type localities, and it would be useful if this fact were added to the label of any specimens found in collections to-day.

I have just had a recent experience of the importance of some such method. In an old collection of shells given to the National Museum of Wales is a set of *Sphærium pallidum* Gray, marked “Paddington”. Now, to anyone living in South Wales, Paddington conjures up only the eastern terminus of the Great Western Railway. Bartholomew’s *Gazetteer* revealed the fact that there is more than one Paddington—one a village in Lancashire and a mile or so north-east of Warrington, and yet another, an ecclesiastical district of Salford County Borough.

There is at the Accrington Museum a collection of 27,000 specimens of Mollusca. A request for information concerning this was readily granted by the Curator, Mr. A. Hanson. The first curator was R. Wigglesworth, a conchologist known to many in the old Manchester days. He was the first to record *Sphærium ovale* (as it was then known) from Lancashire, in 1862, and I now learn that the locality was the Leeds and Liverpool Canal at Clayton-le-moors. This, and a second set taken in 1886, are preserved in the above Museum. An examination of the *Synonymy* put me on the

track of Gray's record, the one from Kensal Green, which is of course in the Metropolitan Borough of Paddington. This, the type-locality, no longer exists conchologically, and there is a definite note to this effect in the *Journal of Conchology* in 1926 (vol. 18, p. 38) by Grensted.

Here, then, is a clear case for investigation and report on the present range of the species in the two counties, Lancashire and Yorkshire. Rimmer in 1880 gave Wakefield and Blue Bridge, near York. One of the earliest pages of this Journal contains Hebden's record in 1874 for Stanley, and there is at Altrincham Museum a fine series taken by Collier and Standen, at a later date, at Hollinwood.

Textbook records, however, may be misleading. Gray's "Turton" of 1857 has, of course, the Kensal Green record only. Reeve, in *Land and Freshwater Shells*, in 1863 adds Daniel's Surrey record, never confirmed. Jeffreys quotes Exmouth (Clark), *Paddington Canal* (J. G. J.), canals and ponds in Lancashire (Darbshire). Clark's collection was given to Turton, and Turton's collection went to Jeffreys, whose collection is now at Washington, U.S.A. The Lancashire record may refer to the Ashton locality (*vide* Jackson in *Journ. of Conch.*, vol. 12, p. 54), which is R. D. Darbshire's unpublished record of 1860.

With this introduction let us turn to the list of British species and see how many can claim to have been first found in Lancashire or Yorkshire, or in North Wales. I have notes of twenty species and shall be glad to hear of others.

1. *Acanthinula lamellata* (Jeffreys), 1830, Yorks.—Jeffreys' original reference is in the *Trans. Linn. Soc.*, vol. xvi, p. 333, "from the neighbourhood of Scarborough, favoured me by Mr. J. S. Miller of Bristol." The type-locality is therefore in all probability Forge Valley.

2. *Amnicola taylori* (Smith), 1901, Lancs.—Smith's description and record appeared in the *Annals and Mag. Nat. Hist.*, series 7, vol. 7, February, 1901. Fred Taylor's first discovery of the species was at Droylsden, Lancs., on 28th April, 1900. In September of the same year the species was again collected in the Peak Forest canal at Dukinfield (*Journ. of Conch.*, vol. 11, p. 9).

3. *Chlamys distorta* (da Costa), 1778, Yorks.—This species, *Pecten pusio* Auctt., is, da Costa says, "found on some of our shores, as in Yorkshire at Scarborough and the mouth of the River Tees, the coasts of Dorsetshire," etc., etc. (*Brit. Conch.*, p. 150). The old saying, "'Tis an ill wind that blows no one any good," may apply here; and the loss of an old name once again brings Scarborough into notice as type-locality for an old species under a changed name.

4. *Colus gracilis* (da Costa), 1778, Yorks.—Another well-known marine species which was first noticed from Scarborough by Martin Lister, and figured by him in *Hist. Conch.*, t. 913, f. 5, under the name *Buccinum Rostratum gracilius*. It is also the *Murex corneus* of Pennant, but no locality is given.

5. *Cultellus pellucidus* (Pennant), 1777, N. Wales.—The type-locality is Red Wharf Bay, Anglesey, as already mentioned, one of the few cases where the record is substantiated by type-specimens in the Pennant Collection at South Kensington.

6. *Gari fervensis* (Gmelin), 1791, Yorks.—This species, the *Psammobia ferroensis* auctt., was first figured by Lister, who found it at Scarborough.

7. *Hanleya hanleyi* (Bean), 1844, Yorks.—First described by Bean in Thorpe's *Brit. Marine Conch.* from specimens obtained at Scarborough on the under-sides of rocks at lowest spring-tides, and still the rarest of the Chitons on our coasts.

8. *Hydrobia ulvæ* (Pennant), 1777, N. Wales.—This species, which occurs in such vast numbers around our coasts, was first described by Pennant from Flintshire. This, and Pennant's *Solen pellucidus*, are the two species from Welsh localities of which type-specimens exist in the Pennant Collection.

9. *Lauria cylindracea* (da Costa), 1778, N. Wales.—In the short list of localities given by da Costa in *Brit. Conch.* is Leeswood in Flintshire, probably one of the unspoilt localities for so common a species.

10. *Lepidochitona cinereus* (Linné), 1767, Yorks.—The earliest record I can find for this, our commonest Chiton, is one by Pennant under the name *Chiton marginatus*. This was at Scarborough, where probably it still exists, as it does in local colonies along most of our shores.

11. *Margaritifera margaritifera* (Linné), 1758, Yorks.—The pearl-mussel, for which some of the rivers of Lancashire and Yorkshire are still productive habitats, was first noted by Lister from the Rivers "Air" and Ribble in Craven and the River Ure near "Rippan" (Ripon), and is the "*Chama-glycemeris margaritifera*" of Lister, and may possibly be assigned also to Lancashire, as this county can certainly claim the Ribble.

12. *Monodonta lineata* (da Costa), 1778, N. Wales.—The earliest records are apparently da Costa's, and he mentions Barmouth, the coast of Flintshire, and Anglesey; also Ince in Cheshire. A fairly general species on our coast, though on the Cheshire coast it may be a thing of the past.

13. *Natica catena* (da Costa), 1778, Yorks.—First recorded by Lister from the mouth of the Humber, according to da Costa in

Brit. Conch., p. 84, in 1698; the other localities which are given are all southern.

14. *Neptunea antiqua* (Linné), 1758, Yorks.—Another well-known species first figured and described by Lister, who received specimens from Scarborough.

15. *Planorbis dilatatus* Gould, 1841, Lancs.—First recorded as British by J. G. Jeffreys in 1869, and from Lancashire, for this was Rogers' record in June of that year, the localities being the Bolton and Gorton canals. According to Fred Taylor this species is not nearly so common as it used to be, probably owing to the many recent stoppages at the mills and the absence of warm water, which this species seems to prefer.

16. *Planorbis lævis* Alder, 1838, Lancs.—First recorded as British by Alder in 1838, and from Burnley, Lancashire, by F. C. Long in June, 1886.

17. *Solen marginatus* Montagu, 1803, N. Wales.—First noticed by Pennant from Red Wharf Bay in Anglesey and recorded as *S. vagina*. Montagu gives (1) Laugharne, Carmarthenshire, as well as Pennant's locality (2) in Anglesey, so that it is difficult to say whether Montagu's Carmarthenshire locality should be recorded as the type-locality. Personally I think it should. Both, however, are historic.

18. *Sphærium pallidum* Gray, 1856, Lancs.—As already mentioned, the second record for this species came from Lancashire. The Middlesex locality has already disappeared and the Lancashire stations may soon be in danger. It would be as well if an intensive survey of the present range of the species were undertaken. Wigglesworth recorded it from Clayton-le-moors in 1862.

19. *Theodoxus fluviatilis* (Linné), 1758, Lancs. and Yorks.—First recorded as British by Martin Lister in 1678 from the River Ouse at Fooforth and Clifton (probably near York), from the River Wharfe and River Lune at "Kerby-Launsdale" on the Lancashire border. As a matter of fact, most collectors know it to be still quite common in the Lune as far south as Lancaster.

20. *Vertigo alpestris* Alder, 1838, Lancs.—This very local species was first recorded as British in August, 1837, the first Lancashire locality being Clitheroe, the collector Gilbertson, from specimens collected (in 1837) nearly one hundred years ago. This reference reads: "4. *alpestris* (Fér.) Ald. Found at Clitheroe, Lancashire, by Mr. Gilbertson; and in Northumberland by Mr. J. Thompson." (*Mag. Zool. and Bot.*, ii, p. 112.)

CATALOGUE OF RECENT LATIAXIS.

By J. R. LE B. TOMLIN.

(Read before the Society, 11th May, 1935.)

LATIAXIS was erected by Swainson in his *Treatise of Malacology*, pp. 82, 306, 1840, for the single species *mawæ* Gray, but has gradually come to be used for a number of beautiful species, very highly decorative in form, and very doubtfully distinct generically from those usually assigned to *Coralliophila*.

The well-known genotype of *Latiaxis* is abnormally loose in coiling, but the operculum is absolutely the same as that of other *Latiaxis* as well as of species which are admitted to be *Coralliophila*—being more or less pear-shaped and having a lateral nucleus.

The catalogue which follows is an attempt to list all the recent species which have at one time or another been assigned to *Latiaxis*. Its position as a genus distinct from *Coralliophila* is thoroughly discussed by Dall in *Bull. Mus. Comp. Zool. Harvard*, vol. 18, p. 217. He seems there to suggest a larger lumping of species than would be accepted to-day, and he also unites *Pseudomurex* Monterosato with *Coralliophila*; this, I think, is quite reasonable, and Thiele in his *Handbuch* is inclined to acquiesce.

armatus, *Latiaxis*. Sowerby, Apr., 1912, *Ann. Mag. N.H.* (8), vol. 9, p. 472, f. 2: Kii. Type in B.M.

Much resembles *pagodus* A. Ad., but has the subperipheral ridge very slightly indicated and is much longer in the spire.

babelis, *Fusus*. Requier, 1848, *Cat. Coq. Corse*, p. 76: Bonifacio.

Figured by Odhner in *Ark. f. Zool.*, vol. 23A, no. 14, pl. i, f. 19, as a var. of *bracteatus* Brocchi and as belonging to *Coralliophila*. = *bracteatus*.

benoiti, *Murex*. Tiberi, 1855, *Descr. Alcuni Nuovi Test.*, p. 15, pl. ii, f. 10–12. Mediterranean. = *bracteatus*.

bracteatus, *Murex*. Brocchi, 1814, *Conch. Foss. Subap.*, vol. 2, p. 409, pl. ix, f. 3.

Described as an Italian Tertiary fossil.

capensis, *Latiaxis*. Tomlin, 1928, *Ann. S. Afr. Mus.*, vol. 25, p. 332, pl. xxvi, f. 3.

Sandy Point, 95 f. Type in S. Afr. Mus.

cariniferus, *Murex*. Sowerby, 1st Oct., 1834. *Conch. Ill.*, parts 66–7, f. 58. = *bracteatus*.

cariniferus, *Murex*. Kiener, 1843, *Coq. Viv.*, p. 100, pl. xviii, f. 2. Hab. ? = *kieneri*.

couturieri, *Latiaxis*. Jousseume, 1st Jan., 1898, *Le Nat.* (2), vol. 20, p. 22. New Britain. = *pagodus* A. Adams.

- deburghiæ**, *Pyrula* (*Rhizochilus*). Reeve, 11th Nov., 1857, *P.Z.S.*, 1857, p. 208, pl. xxxviii, f. 3. China (coll. Barclay). According to Dall it is also as widespread in the Caribbean as it is in the Far East.
- delesserti**, *Rapana*. Tryon, 25th Oct., 1880, *Man. Conch.*, vol. 2, pp. 203, 230, pl. lxiv, f. 346.
Cited from Chenu's vernacular "Pyrule de Delessert" in *Leçons Élém.*, p. 276, pl. ix, f. 4, 4a, 1847. = *mawæ*.
- diadema**, *Murex*. A. Adams, 25th July, 1854, *P.Z.S.*, 1853, p. 70. Philippines (Mus. Cum.). Type in B.M. = *pagodus* A. Adams.
- elegans**, *Latiaxis*. Angas, 1878, *P.Z.S.*, 1878, p. 74. Hab.? = *bracteatus*.
- eugeniae**, *Pyrula*. Bernardi, 1853, *Journ. de Conch.*, vol. 4, p. 305, pl. vii, f. 1. China.
- exfoliatus**, *Latirus*. Sowerby, 1882, *Thes. Conch.*, vol. 5, p. 3, pl. 424, f. 15. New name for *pagodus* A. Ad. non *pagodus* Jonas. There is, however, no *pagodus* Jonas, and the species that Sowerby intended seems to be *idoleum* Jonas. = *pagodus*.
- fimbriatus**, *Trophon*. Hinds, 1844, *Zool. Voy. Sulphur*, vol. 2, p. 14, pl. i, f. 18, 19. Str. Macassar, 11 f. Reeve unnecessarily altered this name to *luculentus* in his monograph of *Murex*, sp. 127.
- finchi**, *Latiaxis*. Fulton, Feb., 1930, *Ann. Mag. N.H.* (10), vol. 5, p. 250, text-figs. 2, 2a. Kii. Type in B.M. = *deburghiæ*.
- fortuni**, *Rapana* (*Latiaxis*). A. Adams, 25th July, 1854, *P.Z.S.*, 1853, p. 99. China (Mus. Cum.). Type in B.M. with author's label. = *eugeniae*.
- fritschi**, *Rapana*. Martens, 1874, *Jahrb. deutsch. Mal. Ges.*, vol. 1, p. 135, pl. vi, f. 3. Cape: cf. *Journ. of Conch.*, vol. 17, p. 46.
- fruticosus**, *Murex* (*Trophon*). Gould, May, 1849, *Pr. Boston Soc. N.H.*, vol. 3, p. 143. New Holland. A dubious species united by Tryon with *Murex noduliferus* Sow.
- fusiformis**, *Pyrula*. Rolland du Roquan, 1853, *Journ. de Conch.*, vol. 4, p. 406. Hab.? Figured by Chenu in *Leçons Élément.*, pl. ix, f. 3, 3a. = *gyratus*.
- fusiformis**, *Coralliophila deburghiæ* var. Dall, June, 1889, *Bull. Mus. Comp. Zool. Harvard*, vol. 18, p. 219. W. Indies. A form without spines. Name preoccupied.
- gravesi**, *Purpura*. Broderip, 19th July, 1836, *P.Z.S.*, 1836, p. 44. Mediterranean. Types in Norris and Broderip collections. The latter (Brod. No. 1450) is now in the B.M. "Figured in *Conch. Ill.* as *Murex cariniferus*." = *bracteatus*.
- gyratus**, *Trophon*. Hinds, 1844, *Zool. Voy. Sulphur*, vol. 2, p. 14, pl. i, f. 14, 15. Str. Macassar, 17 f.

- hindsii*, *Trophon*. Carpenter, 1857, *Rept. 26th Meeting Brit. Assoc.* (1856), p. 205. New name for *T. muricatus* Hds. non Mont.
- idoleum*, *Pyrula*. Jonas, 26th Jan., 1847, *P.Z.S.*, 1846, p. 120. Hab. ? (Mus. Gruner). = *gyratus*.
- japonica*, *Rapana*. Dunker, 1882, *Index Moll. Mar. Jap.*, p. 43, pl. xiii, f. 24, 25. Japan.
- kieneri*, *Latiaxis*. Hidalgo, 1904-5, *Cat. Mol. Test. Isl. Filip.*, vol. 1, *Moll. Mar.*, p. 23. New name for *Murex cariniferus* Kiener non Sow.
- kinoshitai*, *Latiaxis*. Fulton, Dec., 1930. *Ann. Mag. N.H.* (10), vol. 6, p. 685, pl. xviii, f. 1, 1a. Kii. Type in B.M.
- laceratum*, *Murex*. Deshayes, 1856, *Journ. de Conch.*, vol. 5, p. 79, pl. iii, f. 3, 4. Algeria. = *bracteatus*.
- lintoni*, *Trophon*. Verrill and Smith, Nov., 1882, *American J. Sci.* (3), vol. 24, p. 365. New England. Figd. in *Tr. Connecticut Acad.*, vol. 6, p. 176, pl. xxix, f. 1, 1884.
Dall in *Bull. Mus. C.Z. Harvard*, vol. 18, p. 219, places it as a var. of *deburghiæ*.
- lischkeana* *Rapana*. Dunker, 1882, *Index Moll. Mar. Jap.*, p. 43, pl. i, f. 1, 2 ; pl. xiii, f. 26, 27. Japan.
- mawæ*, *Pyrula*. Griffith and Pidgeon, 1834, *Moll. and Radiata*, p. 599, pl. xxv, f. 3, 4. China.
In *Zool. Beechey's Voyage* Gray calls it *mawæ*, and some years later *mairæ*. Jousseume in *Bull. Soc. Zool. France*, vol. 8, p. 186, has *mavæ*.
- muricatus*, *Trophon*. Hinds, 1844, *Zool. Voy. Sulphur*, vol. 2, p. 14, pl. i, f. 16, 17. Panama, 19 f.
May be a *Murex* : see Tryon's *Manual*, vol. 2, p. 202. The name is preoccupied by Montagu and Carpenter changed it to *Trophon hindsii*.
- nodosa*, *Rapana* (*Latiaxis*). A. Adams, 25th July, 1854, *P.Z.S.*, 1853, p. 98. Philippines (Mus. Cum.). Types in B.M.
- pagodus*, *Murex*. A. Adams, 7th Dec., 1853, *P.Z.S.*, 1851, p. 269. Hab. ? (Mus. Cum.). Type in B.M.
- pagodus*, *Latiaxis*. Sowerby, 1882, *Thes.*, vol. 5, p. 3, pl. 424, f. 2, 3. (No loc.) Ascribed to Jonas, and perhaps a MS. name of his. Gray in *Ann. Mag. N.H.* (3), vol. 20, p. 78, mentions a *Latiaxis pagoda* Johnson, which is certainly this. = *gyratus*.
- pilsbryi*, *Latiaxis*. Hirase, Dec., 1908, *Conch. Mag.*, vol. 2, No. 12, App. p. 69, pl. xli, f. 239, 240 ; pl. viii, f. 64d, 64f. Tosa. Type in coll. Hirase.
- princeps*, *Latiaxis*. Melvill, 30th Oct., 1912, *Pr. Malac. Soc. London*, vol. 10, p. 248, pl. xii, f. 15, and text-figs. Persian Gulf, 50 f., and near Mussandam, 55 f. Type in B.M.

- purpurata* *Rapana*. Tryon, 25th Oct., 1880. *Man.*, vol. 2, p. 203, pl. lxiv, f. 345. Taken from the "Pyrule pourprée" of Chenu's *Leçons Élément.*, pl. ix, f. 2, 2a. = *deburghiæ*.
- regalis*, *Fusus babelis* var. Requier, 1848, *Cat. Coq. Corse*, p. 76, Bonifacio. = *bracteatus*.
- rhodostoma*, *Rapana* (*Latiaxis*). A. Adams, 11th Apr., 1855, *P.Z.S.*, 1854, p. 138, pl. xxviii, f. 1. China (Mus. Cum.). Smith is certainly correct in transferring this to *Latirus*.
- ricinuloides*, *Latiaxis*. Schepman, July, 1908, *Siboga-Exp.*, *Prosobr.* pt. i, monograph 49a, p. 359, pl. xxi, f. 7. Station 257.
- rosaceus*, *Latiaxis*. Smith, 31st Oct., 1903, *Proc. Malac. Soc. London*, vol. 5, p. 376, pl. xv, f. 16. Port Elizabeth. Type in B.M. = *fritschi*.
- sallei*, *Latiaxis*. Jousseume, 1883, *Bull. Soc. Zool. France*, vol. 8, p. 186, pl. x, f. 3. Japan. = *japonicus*.
- sibogæ*, *Latiaxis*. Schepman, July, 1908, loc. cit., pl. xxi, f. 8. Station 89.
- spinosa*, *Coralliophila deburghiæ* var. Dall, June, 1889, *Bull. Mus. Comp. Z. Harvard*, vol. 18, p. 219. W. Indies.
- spinosa*, *Coralliophila*. Dall, 1925, *Pr. U.S. Nat. Mus.*, vol. 66, art. 17, p. 14, pl. xxxvi, f. 5, 8. Honshu Is., Japan, 63 f. The same as *spinus* Hirase, *fide* Fulton in *Pr. Malac. Soc.*, vol. 19, p. 19. Apparently not the var. *spinosa* above.
- spinus*, *Latiaxis*. Hirase, Dec., 1908, *Conch. Mag.*, vol. 2, No. 12, App., p. 71, pl. xlii, f. 253-4. Tosa. Type in coll. Hirase. = *pagodus* A. Adams.
- tabulatus*, *Latiaxis*. Schepman, July, 1908, *Siboga-Exp.*, *Prosobr.*, pt. i, monogr. 49a, p. 360, pl. xxi, f. 9. Station 95.
- tectumsinense*, *Murex*. Deshayes, 1856, *Journ. de Conch.*, vol. 5, p. 78, pl. iii, f. 1, 2. Algeria. Type in coll. Deshayes. = *bracteatus*.
- textilis*, *Latiaxis*. Gray, July, 1867, *Ann. Mag. N. H.* (3), vol. 20, p. 78. Error for *tortilis*.
- tortilis*, *Latiaxis*. H. & A. Adams, 1st Apr., 1864, *P.Z.S.*, 1863, p. 431. China. Type in B.M. = *gyratus*.
- tosanus*, *Latiaxis*. Hirase, Dec., 1908, *Conch. Mag.*, vol. 2, App., p. 71, pl. xlii, f. 255-6. Tosa. Type in coll. Hirase. This runs very close to *princeps* and may even be identical.
- turris*, *Purpura* (*Coralliophila*). Mörch, 1872, *Journ. de Conch.*, vol. 20, p. 129, pl. v, f. 4. Hab. ? Probably near Montevideo.
- wilsoni*, *Coralliophila*. Pritchard & Gatliff, 1898, *Pr. Roy. Soc. Victoria*, vol. 10, pt. 140, pl. xx, f. 8, 9. Port Phillip. Cf. Hedley, in *P.L.S.N.S.W.*, vol. 38, p. 331, who thinks it is the same as *nodosa*.
- winckworthi*, *Latiaxis*. Fulton, Feb., 1930, *Ann. & Mag. N.H.* (10), vol. 5, p. 251, text-figs. 1, 1a. Kii. Type in B.M.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND.

628th Meeting (Annual Meeting) held in the Rooms of the Royal Society,
London, on Saturday, 19th October, 1935.

The President (Mr. J. Davy Dean, F.R.E.S.) in the chair.

Amongst those present were Messrs. H. R. Wakefield, A. P. Gardiner, J. R. le B. Tomlin, Chas. Oldham, D. C. Thomas, F. Taylor, Geo. Shrubsole, Arthur Wrigley, H. W. Worsfold, A. Blok, J. E. Cooper, H. C. Fulton, A. G. Stubbs, G. C. Spence, A. E. Ellis, Dr. J. W. Jackson, Professor A. E. Boycott, Lieut.-Col. A. J. Peile, Capt. C. Diver, Mrs. J. D. Dean, Mrs. Morehouse, Miss J. D. Robertson, Mr. and Mrs. A. S. Kennard, Mr. and Mrs. R. Winckworth, Mr. and Mrs. W. J. Davey, Mrs. Bowell, and Dr. John H. Boycott.

Election of Scrutineers.

Messrs. A. Blok and H. W. Worsfold were elected Scrutineers.

Election of Auditors.

Messrs. C. H. Moore and A. K. Lawson were elected Auditors.

Candidates Proposed for Membership.

L. C. D. Hermitte, M.B., Ch.B., D.T.M. and H., 32 Rutland Park, Broomhill, Sheffield, 10 (introduced by Lieut.-Col. A. J. Peile and Dr. J. W. Jackson).

D. C. Thomas, 13 Queen's Road, Ealing, London, W. 5 (introduced by Professor A. E. Boycott and Dr. J. W. Jackson).

Henry D. Russell, 182 Marlboro Street, Boston, Mass., U.S.A. (introduced by William J. Clench and J. R. le B. Tomlin).

Wm. T. Trewin, c/o W. James Bailey, 250 Gillott Road, Edgbaston, Birmingham (introduced by C. Theodore Cribb and Dr. J. W. Jackson).

Seville Wilson Brooks, 129 Hornby Road, Blackpool (introduced by Miss Nora Fisher and Dr. J. W. Jackson).

John Bernström, 9 Sköldungagatan, Stockholm, Sweden (introduced by H. Schlesch and Dr. J. W. Jackson).

Hon. Member Deceased.

Ph. Dautzenberg.

Member Resigned.

K. Howell.

Papers Read.

A number of papers was taken as read.

Presidential Address.

The President delivered an address on "Conchological Cabinets of the last Century", and a cordial vote of thanks was passed unanimously.

Votes of thanks were also accorded to the authorities of the Royal Society and the Manchester Museum for the use of rooms for meetings.

Election of Officers and Council.

The Officers and Council nominated for 1935-6 were unanimously elected. The President is Lieut.-Col. A. J. Peile. The retiring President, Mr. J. Davy Dean, becomes a Vice-President. No other changes were made.

Exhibits.

By Mr. C. Oldham : *Planorbis corneus* (Linné) var. *pyrrholeuca* Oldham. The F₁₂ generation of two similar shells. In no generation has there been any departure from this type of coloration : *Limnæa involuta* Thompson, Loch Fleodach Coire, Inchnadamph, Sutherland, 28th June, 1935 ; holocene *Vertigo genesii* from Herts ; *Pisidium vincentianum* Woodward, Pleistocene of Sittingbourne, Kent (J. P. T. Burchell).

By Mr. A. R. Waterston : Giant *Limnæa truncatula* from Barra, Hebrides (10·7 mm. long) with an average English specimen (5·5 mm.) for comparison.

By Mr. A. E. Ellis : *Assiminea grayana* Leach collected by Mr. E. A. Ellis, of Norwich Castle Museum, in the following localities in Norfolk and Suffolk : King's Lynn (18th April, 1929), Scolt Head (29th May, 1934), River Bure at Great Yarmouth (2nd May, 1929), St. Olave's Bridge, Haddiscoe (26th April, 1929), Lake Lothing, Lowestoft (5th March, 1933), and Blythburgh (April, 1929). The specimens were accompanied by ecological notes and a sketch-map showing the distribution of the species in East Anglia.

By Mr. H. W. Worsfold : A small series of Cuban land-shells and species of Cardiidae belonging to the genera *Cardium* and *Corculum*.

By Mr. R. A. Phillips : Recent *Vertigo genesii* from Ireland.

By Lieut.-Col. Peile : Shells of all the known species of *Poecilozonites*, recent and fossil ; shells and radulæ of *Macrochlamys glauca* Pfr. from Garhwal.

By Mrs. Morehouse : *Nucella lapillus* var. *imbricata* ? from Tenby ; *Liguus*, *Chondrothyra*, and *Viana regina* Mor. from Cuba.

By Mr. A. G. Stubbs : Handsomely marked series of *H. aspersa* from Sussex ; *L. stagnalis* var. *variegata*, Lewes ; *Helicella heripensis*, Sussex ; drawings of mollusca and of fungi ; necklaces of shells.

By Mr. W. Fowler : *Eulimella macandrei* Forbes, *Propilidium exiguum* Thompson, *Lepeta fulva* Müller, and *Hædropleura septangularis* Mont. dredged off Oban ; also a very large *Emarginula crassa anassa* Dean from near Oban, measuring 2·8 × 3·8 × 1·9 cm.

By Mr. G. L. Wilkins : Models of British Nudibranchs, including *Lomanotus marmoratus*, A. & H., *Thecacera pennigera* Mont., *Palio dubia* M. Sars, *Okenia aspersa* A. & H., and *Doris coccinea* A. & H. ; also *Buccinum undatum* L. juv., and *Neritina pulligera* L.

By Mr. A. P. Gardiner : The British Pleurobranchidae according to Engel, viz. *Pleurobranchus membranaceus* Mont., *P. (Berthella) plumula* Mont., *P. (Bouvieria) perforatus* Ph. ; also *Lamellaria perspicua* L., shells and animals, showing female and ova in the Ascidian *Leptodinium maculosum*.

By Mr. F. Taylor : *H. nemoralis*, showing colour and band variation, and darts, *H. aspersa* and darts, *H. virgata* and vars.—all collected at Cleveleys, Lancs., in August last.

By Mr. J. R. le B. Tomlin : Sinistral *Vallonia pulchella* ; a long series of Continental *Cochlicella acuta* Müll. ; rare Cypræidæ, including *C. hungerfordi* Sow. (type), *C. kiiensis* Roberts, *C. petitiana* Crosse, *C. vredenburghi* Schilder and *C. hirasei* Rob. (said by Schilder to be the second known specimen) ; *Alora gouldii* A. Adams from the Bay of Panama (coll. A. H. Cooke) ; *Cancellaria trigonostoma* Blv., *C. antiquata* Hinds, *C. corbicula* Dall from 1,100 fms. off Cuba and other species.

By the President : Specimens from the Dillwyn Collection, now in the National Museum of Wales at Cardiff, including five proposed lectotypes, viz. *Murex scolopax*, *Venus tiara*, *Distorsio mulus*, *Bullia cochlidium*, and *Euchelus quadricarinatus* ; also *Nucella crispata* Lam. (Dillwyn's *Buccinum crispatum*) and *Cardium papyraceum* Brug. ; both valves of the *Cardium* are marked—one marked "papyra^m" is probably Dillwyn's writing ; the other valve is marked *nitidus* ; Dillwyn wrote : "I bought this shell of Humphreys," so the *nitidus* may be Humphreys' writing.

By Mr. J. E. Cooper: Thirteen species of curious lamellibranchs, including *Trisis*, *Malleus*, *Pedum*, *Ephippodonta* (both species), *Corculum*, *Brechites*, and *Meiocardia*.

By Mr. A. Blok: A series of *Cerion*, mostly received from Maynard; *Cypræa tigris* L., showing variation in colour and size; examples of mother-of-pearl counters and thread-winders of the Victorian period; Canon Norman's copy of Turton's *Land and Freshwater Shells*, with manuscript notes and addenda; holograph letter from Turton to unknown recipient, April, 1828, acknowledging receipt of a parcel of shells and referring to diagnoses of others; holograph letter from J. E. Gray to Alder, May, 1838, asking for information for use in his forthcoming revision of Turton's *Land and Freshwater Shells*, and asking also for specimens for the British Museum collection; example of engraved Nautilus shell, period the early 1850's—from the legend on the back of the first whorl it will be seen that the whole of the engraving was "executed with a common penknife".

ANNUAL REPORT.

This is the fifty-ninth Annual Report of the Society. Since the last Annual Meeting the losses to the Society have been heavy; five members by death and four by resignation. Only one new member has been elected, but there are six nominations in hand. The membership at present is 213, including 3 Honorary Members.

The losses by death are the Rev. A. H. Cooke (see Obit., p. 77), E. W. Bowell (see Obit., p. 101), G. C. Leman, Mrs. G. B. Longstaff, and Ph. Dautzenberg, an Hon. Member (see p. 154).

Five ordinary meetings have been held at the Manchester Museum, by the kind permission of the authorities. In addition, on the 10th November there was a joint meeting with the Yorkshire Conchological Society at Leeds. This was well attended and many interesting exhibits were shown. Mr. K. G. Howell, the President of the Yorkshire Society, was in the chair, and Mr. G. C. Spence gave an interesting talk on *Urocoptis*, illustrating his remarks with many specimens from his own collection. On the 6th April a similar joint meeting was held at the Manchester Museum, and again there was a good display of specimens, chiefly of local interest. The President, Mr. J. Davy Dean, was in the chair and gave an address on "Historical or Type Localities of British Mollusca".

Two Special Exhibits were held during the year, these being "Cypræa" and "Past and Present Mollusca of the Manchester District".

Eight notes and papers have been communicated during the year and some have since appeared in the *Journal*. One of special importance is that by J. A. Stevenson, on "Cephalopods of the Yorkshire Coast".

Three numbers of the *Journal* have been issued to members since the last Annual Meeting, viz. Vol. 20, No. 3, 21st December, 1934, with 32 pages of text, 1 plate, and 2 text-figures; Vol. 20, No. 4, 2nd April, 1935, with 32 pages of text, 5 plates, and 1 text-figure; and Vol. 20, No. 5, 22nd August, 1935, with 32 pages of text.

Additions to the Library have been received from Messrs. H. Schlesch, E. A. Ellis, C. Oldham, Curt Krausp, H. Watson, R. MacDonald, F. Baker, Rev. E. P. Blackburn, Rev. G. A. F. Knight, and Miss Tera van Benthem Jutting.

Additions to the Cabinet have been received from Messrs. H. Schlesch (photos and various); C. Oldham (*Limnæa pereger* var. *involuta*, from Inchnadamph, Sutherland, 28.6.35); D. K. Kevan (numerous voucher specimens from Easternness, v.c. 96; Ross E., v.c. 106; Sutherland E., v.c. 107; and Sutherland W., v.c. 108; all July, 1935); and a handsome gift of radula slides from Mrs. Bowell (from her late husband's collection).

RECORDER'S REPORT (Non-Marine Mollusca).

SINCE the last report (Vol. 20, p. 156) 206 new records have been authenticated for the census. The most important novelties are *Limnæa involuta*, hitherto known only from south-west Ireland, discovered by C. Oldham in Loch Fleodach Coire, 2½ miles north-east of Inchnadamph, in Sutherland West, and *Vertigo genesii* (see this *Journal*, 1925, Vol. 20, p. 142), which comes into the census for the first time from four localities in central Ireland, found by R. A. Phillips. A number of old records have also been verified from collections in the hands of A. S. Kennard and the Scottish workers have again added many items.

As K. J. Morton (*Scot. Nat.*, 1934, p. 83) has pointed out, W. D. Roebuck, in his paper in the same journal (1916, p. 107) and, I may add, in the map he left for the Society's recorders, fell into error over the boundary between Easternness and Westernness. H. C. Watson prescribed that it should be the watershed between the east and west of Scotland and this Roebuck brought across the Great Glen in an impossible position about half-way along Loch Ness. It actually crosses immediately to the north of Loch Lochy, and Glen Moriston and Glen Garry, with Lochs Oich, Garry and Quoich are in Easternness and not, as Roebuck supposed, in Westernness. G. C. Druce's map in the *Comital Flora of the British Isles* is also wrong, but not so wrong as Roebuck's, while the true position is shown (on a small scale) by B. N. Peach and J. Horne on plate xvii of vol. i of the *Bathymetrical Survey of Scottish Fresh-water Lochs* (1910). Until this year the Census had no records from the mislaid area.

Specimens for authentication should in future be sent to Professor A. E. Boycott, Ewen Farm House, near Cirencester.

Devon S. (3): *Cæcilioides acicula* (A. S. Kennard), *Planorbis corneus*, *Sphaerium rivicola* (Exeter Canal, A. E. Boycott).

Somerset N. (6): *Milax gracilis* (A. E. Ellis), *Acanthinula aculeata* (F. A. Knight).

Dorset (9): *Columella edentula* (W. D. Sutton).

Isle of Wight (10): *Helicella heripensis* (L. E. Adams), *Phytia myosotis* (H. W. Bristow, 1852, and J. E. Cooper).

Hants S. (11): *Vertigo substriata* (H. and J. Groves, 1877).

Sussex W. (13): *Vertigo substriata* (H. Groves, 1878).

Kent E. (15): *Azeca tridens* (McAndrew coll.), *Pupa secale* (H. C. Huggins).

Kent W. (16): *Eulota fruticum* (Penshurst, E. W. Bowell), *Vertigo antivertigo*, *V. substriata*, *Columella edentula* (F. H. Gripper), *Helix rupestris*, *Hygromia fusca*, *Planorbis carinatus*, *Neritina fluviatilis* (A. S. Kennard).

Essex S. (18): *Helix arbustorum* (F. Corner), *Vertigo pusilla* (F. Taylor), *Clausilia laminata* (A. S. K.), *Limnæa glabra* (H. Groves, 1877), *Sphaerium rivicola* (J. E. C.).

Essex N. (19): *Vallonia excentrica* (J. French), *Vertigo pygmæa* (B. B. Woodward).

Herts (20): *Clausilia biplicata* (Tring, W. Whitaker, 1870).

Middlesex (21): *Sphaerium ovale* (Paddington Canal, J. Groves, 1875).

Oxford (23): *Milax sowerbii* (L. W. Grensted).

Suffolk E. (25): *Limnæa glabra* (C. Reid), *Paludestrina ventrosa* (J. E. C.).

Norfolk E. (27): *Vallonia pulchella*, *Assiminia grayana* (E. A. Ellis), *Paludestrina ventrosa* (J. E. C.).

Norfolk W. (28): *Punctum pygmæum* (A. Mayfield), *Truncatellina cylindrica* (Thetford, per F. N. Haward), *Assiminia grayana* (E. A. E.).

Northampton (32): *Pisidium pulchellum* (E. P. Blackburn).

Gloucester E. (33): *Limax cinereoniger*, *L. tenellus*, *Arion minimus* (A. E. B.).

Hereford (36): *Sphaerium rivicola* (E. W. B.).

Worcester (37): *Hyalinia rogersi* (N. G. Hadden).

Warwick (38): *Cæcilioides acicula* (J. H. Bloom).

- Stafford (39): *Planorbis glaber* (H. Overton).
- Salop (40): *Planorbis carinatus*, *Pisidium milium*, *P. pulchellum* (C. Oldham and A. E. B.).
- Pembroke (45): *Limnæa glabra* (A. L. Leach), *Planorbis glaber* (J. Groves).
- Montgomery (47): *Planorbis corneus*, *Pl. contortus*, *Paludestrina jenkinsi*, *Anodonta anatina* (C. O. and A. E. B.).
- Denbigh (50): *Limnæa stagnalis* (C. O. and A. E. B.), *Paludestrina ventrosa* (F. T.).
- Yorks M.W. (64): *Milax gagates* (garden, C. O. and A. E. B.).
- Durham (66): *Helicella heripensis* (R. H. Lowe), *Vertigo antivertigo* (J. R. Crawford), *Truncatellina cylindrica* (Claxheugh, R. House, 1848), *Pisidium pulchellum* (E. P. B.).
- Northumberland S. (67): *Pisidium pulchellum* (E. P. B.).
- Northumberland N. (68): *Helicella heripensis* (W. Philipson), *Pupa anglica* (E. P. B.), *Succinea putris*, *Valvata piscinalis* (M. V. Lebour), *Pisidium pulchellum* (K. B. Blackburn).
- Kirkcudbright (73): *Planorbis vortex* (F. R. Cotes), *Pisidium pulchellum* (D. K. Kevan).
- Ayr (75): *Helicella caperata caperata* (W. Evans), *Pisidium lilljeborgii*, *P. milium*, *P. nitidum*, *P. subtruncatum* (A. R. Waterston).
- Lanark (77): *Limax arborum*, *Vertigo substriata*, *V. lilljeborgi*, *Succinea pfeifferi* (D. K. K. and A. R. W.), *Pisidium amnicum* (D. K. K.).
- Peebles (78): *Vallonia excentrica* (D. K. K. and A. R. W.).
- Selkirk (79): *Punctum pygmæum*, *Vertigo antivertigo*, *V. substriata*, *Planorbis complanatus*, *Pl. fontanus*, *Valvata piscinalis*, *V. cristata* (D. K. K. and A. R. W.), *Pisidium milium*, *P. nitidum*, *P. pulchellum* (D. K. K.).
- Roxburgh (80): *Agriolimax lævis*, *Arion minimus*, *Vertigo lilljeborgi*, *Succinea pfeifferi* (D. K. K. and A. R. W.), *Helicella caperata caperata* (J. Roseburgh), *Pisidium hibernicum*, *P. lilljeborgii*, *P. milium*, *P. nitidum*, *P. subtruncatum* (D. K. K.).
- Berwick (81): *Vallonia pulchella* (A. R. W.).
- Edinburgh (83): *Pisidium amnicum* (W. Evans and A. R. W.).
- Fife (85): *Vallonia excentrica*, *Planorbis complanatus*, *Anodonta anatina* (A. R. W.).
- Stirling (86): *Helicella caperata caperata* (W. Evans), *Ancylus lacustris* (D. K. K. and A. R. W.).
- Perth W. (87): *Vertigo antivertigo*, *Limnæa auricularia acuta*, *Pisidium lilljeborgii* (A. R. W.), *Valvata cristata*, *Pisidium henslowanum* (D. K. K. and A. R. W.).
- Perth E. (89): *Pisidium pulchellum* (A. R. W.).
- Kincardine (91): *Vallonia excentrica*, *Vertigo pusilla*, *Paludestrina jenkinsi* (J. E. Forrest and A. R. W.).
- Aberdeen S. (92): *Vertigo lilljeborgi*, *Columella edentula*, *Succinea pfeifferi*, *Limnæa palustris*, *Physa fontinalis* (J. E. F. and A. R. W.).
- Easternness (96): *Vertigo lilljeborgi* (J. E. F.), *Zonitoides excavatus*, *Ashfordia granulata*, *Helix nemoralis* (by L. Oich), *Pupa anglica*, *Vertigo antivertigo*, *Limnæa palustris*, *Planorbis spirorbis*, *Paludestrina stagnalis* (D. K. K.), *Pisidium conventus* (C. O.).
- Ebudes S. (102): *Pupa anglica* (K. H. Jones).
- Ebudes N. (104): *Vertigo lilljeborgi* (J. E. F.).
- Ross W. (105): *Pisidium lilljeborgii*, *P. nitidum* (A. R. W.).
- Ross E. (106): *Hyalinia pura*, *Hy. crystallina*, *Zonitoides nitidus*, *Punctum pygmæum*, *Vertigo pygmæa*, *V. substriata*, *Columella edentula*, *Clausilia rugosa*, *Succinea pfeifferi*, *Carychium minimum*, *Phytia myosotis* (D. K. K.).
- Sutherland E. (107): *Hyalinia radiatula* (D. K. K.).
- Sutherland W. (108): *Planorbis nautileus* (M. I. Crichton), *Vertigo substriata* (D. K. K.), *Hyalinia cellaria*, *Hy. nitidula*, *Hy. crystallina*, *Arion subfuscus*, *Vallonia excentrica*, *Vertigo antivertigo*, *V. pygmæa*, *Carychium minimum*, *Succinea pfeifferi*, *Limnæa involuta*, *Valvata piscinalis* (C. O.).

Hebrides (110): *Planorbis spirorbis* (C. Elton), *Limax maximus*, *Milax gagates*, *Hyalinia fulva*, *Vallonia costata*, *Pisidium hibernicum*, *P. milium*, *P. subtruncatum* (A. R. W.).

Orkney (111): *Hyalinia nitidula*, *Pupa marginata*, *Planorbis glaber* (K. H. J.).

Shetland (112): *Hyalinia crystallina* (K. H. J.).

Down (115): *Paludestrina ventrosa* (A. W. Stelfox).

Donegal E. (119 E): *Limnæa palustris*, *Amphipeplea glutinosa*, *Planorbis carinatus*, *Pl. albus*, *Valvata piscinalis*, *Succinea pfeifferi* (H. Trevelyan).

Fermanagh (120): *Planorbis spirorbis* (H. T.).

Kildare (125): *Vertigo antivertigo*, *Amphipeplea glutinosa* (D. K. K.), *Neritina fluviatilis* (A. R. W.).

Wexford (127): *Vertigo moulinsiana* (R. A. Phillips).

Kilkenny (129): *Phytia myosotis* (D. K. K.).

Queen's Co. (130): *Vertigo genesii* (R. A. P.).

King's Co. (131): *Hyalinia alliaria* (R. A. P.).

Westmeath (132): *Planorbis glaber* (H. and J. Groves).

Roscommon (134): *Helicella heripensis* (R. A. P.).

Galway N.E. (140 N): *Vertigo genesii*, *Limnæa palustris* (R. A. P.).

Galway S.E. (140 S.): *Vertigo genesii*, *V. lilljeborgi*, *Planorbis contortus* (R. A. P.).

Clare (141): *Vertigo moulinsiana*, *V. lilljeborgi* (R. A. P.).

Tipperary N. (143): *Helicella caperata caperata*, *Vertigo moulinsiana*, *V. genesii* (R. A. P.).

Tipperary S. (144): *Helicella caperata caperata* (R. A. P.).

Waterford (145): *Helicella caperata caperata* (R. A. P.), *Phytia myosotis*.

Kerry S. (148 S.): *Helicella caperata caperata*, *Ashfordia granulata*, *Succinea pfeifferi* (A. W. S.).

MARINE RECORDER'S REPORT.

Dr. H. Engel, in a paper on "The English Species of the family Pleurobranchidae", pronounced specimens sent to him from Guernsey, Oban, Salcombe, and Plymouth by R. Winckworth, A. P. Gardiner, G. C. Robson, and E. S. Allan respectively, to be *Pleurobranchus perforatus* (Philippi). It now appears that these are the true *Berthella plumula* (Montagu) of Winckworth's list, while the animal which up to now has been thought to be this species is quite different. In any case, we now have three distinct species, not two.

Dr. N. B. Eales kindly brought me a number of Chitons from Tenby. It is evident from these that *Acanthochitona discrepans* (Brown) is still very numerous at that place. The President tells me that this has been found by W. Fowler at Holyhead; this is a new station for the species.

At my request, J. E. Cooper has sent me particulars of the distribution of thirty-six selected species of outstanding importance in the matter of dividing our coast into areas. His information is founded on his own collecting or on specimens in his collection from reliable sources.

I should be grateful for further facts about the following among them:—

1. *Osilinus lineatus* (da Costa).
2. *Cantharidus exasperatus* (Pennant).
3. *Patella depressa* (Pennant).
4. *Patella athletica* (Bean).
5. *Acteon tornatilis* L.
6. All species of *Lima*.
7. All species of *Cardium*.

Of these, (1) does not seem to occur in the English Channel east of Chideock, Dorset. From that place I have found it right round the coast

up to Minehead, Somerset. (2) does not seem to exist in the Channel east of Studland. I think that these are two examples of species which will be found to be very important in mapping out areas.

W. Fowler has sent a long list from Oban. It is not to be expected that many species would be found new to such a well worked place, but he has sent several items of interest.

Margarites groenlandicus (Gmelin) occurred in very large numbers in the roots of *Laminaria* dredged off Kerrera.

Eulimella macandrei (Forbes) was dredged in considerable numbers in Kerrera Sound, and seems to be an addition to the Oban list.

A pure white form of *Gibbula cineraria* (Linné) was found on *Laminaria*.

Odostomia eulimoides (Hanley) was found on the ears of *Chlamys striata* (Müller) as well as on *Aequipecten opercularis* (Linné) and *Pecten maximus* (Linné).

St. G. Byne found five "bones" of *Sepia rupellaria* = *Parasepia orbigniana* (Férussac) on beaches near Falmouth, and five *Crepidula fornicata* (Linné) in beach rubbish at Helford. These were probably brought with oysters introduced into the oyster farm at Port Navis. Great care should be taken to guard against the introduction of this species into the beds.

Miss Norah Fisher finds *Patina pellucida* L. on *Laminaria digitata* (see paper). This observer has done valuable work on the occurrence of *Archidoris flammea* (A. and H.); she finds it generally on *Hymeniacidon sanguinea* (see paper).

It occurred at Lough Ine, Co. Cork, not on this weed (Renouf). Dr. Eales and Miss K. M. White allowed me to inspect species collected at Lough Ine. These included *Alderia modesta* (Lovén). Miss White also reports *Ianthina* cast up alive at Marazion.

Full lists and particulars of all the above observations have been made and recorded for future use.

The Recorder will be grateful if any observers who do not enjoy collecting and dissecting slugs will send him any examples of Pleurobranchidæ that they may find. By so doing they will help to increase our knowledge of the occurrence of the three British species of this family.

LIBRARIAN'S REPORT.

THE work of cataloguing has been steadily continued during the past twelve months.

In connection with the J. W. Taylor library, 470 works have been card-indexed and listed.

The landshells in the smaller cabinet have been arranged and catalogued.

ANNUAL REPORT OF THE YORKSHIRE CONCHOLOGICAL SOCIETY.

WE welcome Miss Kathleen Morehouse, of Leeds, to the Presidential Chair this year.

Up to the time of submitting this report, nine meetings have been held. The first meeting of the session was devoted to short papers by members and general exhibits, with considerable success. The February meeting was one for exhibits, and in March a highly interesting lecture on "The Anatomy of the Gastropoda" was the Presidential Address. In April we joined forces with the parent society at Manchester, as reported elsewhere. The May meeting was in charge of Mr. J. Digby Firth, who conducted members to the Leeds Museum and displayed some of the recent additions to the conchological collections, by kind permission of the Museum authorities.

During the summer, excursions were made to York, Tag Lock, Brighouse, and Ledston Luck, in June, July, and September respectively.

The 39th Annual Meeting was held in Leeds in October.

As pointed out in a special Report of the Council, the officers of the Society view with apprehension the small attendances which have been a most adverse feature during this year, and it is hoped to put in hand special arrangements to endeavour to increase the attendances at future meetings.

In November we are to entertain the parent Society at a joint meeting in Leeds, when Mr. H. J. Armstrong will address the meeting, his subject being "Shell Money."

The session will close with the December meeting for general exhibits. Membership now stands at 29.

JOHN R. DIBB,
Hon. Secretary.

ANNUAL REPORT OF THE LONDON BRANCH.

NINE meetings have been held during the past year, each equally successful. Membership remains practically the same as last year. The meeting held on 19th November, 1934, was a special one to celebrate the 40th Anniversary of the London Branch. Mr. J. Cooper, who was Secretary for some twenty-five years, gave reminiscences of the early work of the Branch, and exhibited a notice of a meeting held at the Borough Polytechnic in February, 1895, at which Mr. A. S. Kennard gave an address on the Subfossil Mollusca of Crayford. It is satisfactory to be able to record that Mr. Kennard is still a staunch supporter of the Branch, and was in the Chair at this 40th Anniversary Meeting. The actual announcement in *Science Gossip* of the formation of the London Branch by Canon Horsley, in November, 1894, was also shown.

Another meeting which calls for particular remark was that held on 18th February, 1935, when Mr. A. Blok spoke at some length upon Pearls, describing their growth, structure, and general aspect, touching upon the industry of both the natural and the artificial product. Exhibits were plentiful, for Mr. Blok obtained excellent examples of pearl structures, both natural and cultured; altogether, a most satisfactory evening.

The Syllabus for 1935-36 is now in circulation, and the undersigned will take pleasure in sending copies to any members or friends interested in the work of the Branch.

G. L. WILKINS,
Hon. Secretary.

ANNUAL REPORT OF THE NORTH STAFFORDSHIRE BRANCH.

OWING to the exceptionally dry season, Land Mollusca have not been much in evidence. However the few members of this Branch have spent many pleasant outings searching and observing. Messrs. H. Emmett and J. H. Goodson report a thriving and well established colony of *H. caperata* at Froghall, in the Churnet Valley, which they are led to believe is a new locality for this species in Staffs. *Clausilia laminata* is about extinct in its old locality at Consall, Churnet Valley, but has turned up in fair numbers half-a-mile lower down the valley, where one specimen of *E. obscura* was found in association with it. *Ancylus fluviatilis* var. *alba* still flourishes in its recorded habitat in Dovedale.

Messrs. J. and W. Hill, of Leek, have supplied the following interesting notes. A new locality for *Physa heterostropha* in good numbers in the canal at Cheddleton, and on the same day some very fine shells of *S. ovale* were

obtained; this species is rare and local in North Staffordshire. From Endon they obtained eight species of *Pisidium*, viz.: *P. hibernicum* (one specimen), *P. nitidum*, *P. henslowanum*, *P. subtruncatum*, *P. obtusale*, *P. milium*, *P. casertanum*, and *P. personatum*. *H. caperata*, two specimens of the very beautiful and rare var. *obliterata* taken near Cheddleton; in the same locality *H. nemoralis* band formula (12)000 has reappeared where specimens were taken two years ago. *V. substriata*, two specimens obtained from a marsh near Consall.

On 6th October a joint ramble by Messrs. H. Emmett, J. H. Goodson, and J. and W. Hill, in the Churnet Valley, proved very successful. *H. fusca* turned up in good numbers, and the party obtained an excellent series of *H. caperata*. Mr. W. Hill got a very nice specimen of *P. rotundata* var. *alba*. Other species taken were *V. crystallina*, *V. radiatula*, and *E. fulvus*.

We regret the filling in of many ponds in our neighbourhood owing to the advance of the builder, ponds that yielded good shells and other forms of aquatic life.

A collection of British Land and Fresh-water Shells, rich in Staffordshire species, is housed at the Hanley Museum, Stoke-on-Trent, and may be consulted on application to the Curator.

We are still alive and active, and hope to appoint another President in the near future.

Mr. C. Oldham has kindly named the *Pisidia*.

B. BRYAN,
Hon. Secretary.

Two editions of vol. i of *The Conchologist*.—It is not universally known that two editions of vol. i of *The Conchologist* were published. The original edition was a quarto, edited by Walter E. Collinge, and published in London in 1891. Details of the dates of publication of the four parts are as follows: No. 1, pp. 1-16, 25th March, 1891; No. 2, pp. 17-32, 24th June, 1891; No. 3, pp. 33-48, 29th September, 1891; No. 4, pp. 49-58, 24th December, 1891. Title-page, index, and preface to vol. i published with No. 4. This edition seems to be less known, almost all libraries having the second edition, an octavo reprint. In reply to an inquiry from one of us, Mr. Collinge wrote (4/4/1917) that "*The Conchologist* was originally issued (vol. i) as 4to and later this volume was reprinted as 8vo". In a further letter (12/4/1917) Mr. Collinge said "Certainly publish a note *re The Conchologist* if you think fit. The reason of the reprint in 8vo was the inconvenient shape of the original vol. i. It was reprinted, as near as I remember, early in 1903". The pagination of the second (reprinted) edition is as follows: No. 1, pp. 1-24; No. 2, pp. 25-48; No. 3, pp. 49-72; and No. 4, pp. 73-88.—J. R. LE B. TOMLIN and NORA FISHER. (*Read before the Society, 19th October, 1935.*)

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CONTENTS.

	PAGE
List of Officers and Council	193
List of Members	194
Distribution of <i>Pl. corneus</i> in Ulster—R. MACDONALD	194
Engel's Paper on "The English Species of the Family Pleurobranchidæ"—A. P. GARDINER	195
<i>Neritina fluviatilis</i> in Orkney (with Map)—A. E. BOYCOTT	199
Description of a New Species of <i>Macrocallista</i> (with figures)— W. J. CLENCH and R. A. MACLEAN	201
Studies of African L. & F.W. Moll.: Notes on <i>Edentulina</i> Pfr. with Descriptions of New Species (pl. 8 and text-figures)— J. BEQUAERT and W. J. CLENCH	204
Apparent Disappearance of <i>L. peregra</i> from Friston Pond, Eastbourne Downs—G. SHRUBSOLE	217
Proceedings: 2nd November, 7th December, 1935; 4th January, 1936	218
Accounts	220
Some interesting Monstrosities in Cypræidæ (plate 9)—Dr. F. A. SCHILDER	222
Colonization of Land Shells—A. E. BOYCOTT	224
Habits of young <i>H. pomatia</i> —A. E. BOYCOTT	224
<i>Monodonta lineata</i> (da Costa) in N. Wales—Miss N. FISHER	224
Plates 8 and 9.	

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The Distribution of *Planorbis corneus* (Linné) in Ulster.—It is now almost five years since the appearance in this *Journal* (Vol. 19, p. 119) of a note on the above subject. Its occurrence in Ulster is of considerable interest, as until the beginning of the present century it was only known to occur in Ireland in Co. Kildare and the north-east corner of Queen's County. In the spring of 1930 Miss Nora Fisher found it plentiful in a pond in the grounds of the Glenville Hotel, Cushendall (*Irish Nat. Journal*, vol. iii, p. 90). Later it was discovered in another pond at the same place—probably introduced in both cases. In one of these it was associated with *Limnæa pereger* (Müll.). Since this discovery, which was the first record for Ulster, *Planorbis corneus* has been found in several other localities in Northern Ireland, in all of which it is probably safe to say that it has been introduced. In June, 1933, Mr. R. J. Welch, while with a party of the Belfast Naturalists' Field Club on the banks of the River Lagan—a canalized river—between Drumbridge and Shaw's Bridge, obtained a single immature specimen near the former place; careful search did not reveal any others in this portion of the canal (*Irish Nat. Journal*, vol. iv, p. 200). Mr. Welch the same year found it in very large numbers in the pond of the new Spanish Garden at Mountstewart demesne, Ards, Co. Down, where an unpigmented form possessing a red body also occurs. Mr. D. J. Carpenter, of the Belfast Field Club, and I paid several visits this summer to various parts of the Lagan Canal to determine how far it might have spread since it was first noticed two years ago. We found that it occurs in great numbers between Drumbridge and Shaw's Bridge, and in two small backwaters at Newforge (Belfast side of Shaw's Bridge), but not in the main canal itself on this side of Shaw's Bridge, but could not be found in the canal between Drumbridge and Lisburn. In the Lagan canal it is associated with *Limnæa pereger* (Müll.), *L. stagnalis* (L.), *Planorbis albus* Müll., *P. carinatus* Müll., and *Bithynia tentaculata* (L.). The only previous find of this species in the Northern half of Ireland appears to be the specimens found by the late W. F. de V. Kane in a lily pond at Markree Castle, Sligo, and given to Welch, who recorded the find in the *Irish Naturalist*, vol. x, p. 131, 1901.

R. MACDONALD.

ENGEL'S PAPER ON "THE ENGLISH SPECIES OF THE FAMILY PLEUROBRANCHIDÆ".

By A. P. GARDINER, B.Sc.

(Read before the Society, 7th December, 1935.)

ENGEL points out that British zoologists have up to the present considered that there are two English species in this section of animals, viz. :—

Pleurobranchus (*Berthella*) *plumula* (Montagu).
 „ (*Oscanius*) *membranaceus* (Montagu).

There has been no difficulty about the latter ; its large size, thin shell, characteristic shape, and many other features mark it off so clearly that it is not necessary to consider it further. Under the former name, however, Engel has shown very clearly that two species exist in Britain. He points out that British zoologists have in the past called all members of this group *plumula* if they were evidently not *membranaceus*.

As a result of examination of animals sent to him from Plymouth, Salcombe, Guernsey, and Oban, by Dr. E. J. Allen, Mr. G. C. Robson, Mr. R. Winckworth, and the writer of this paper, Engel concluded that the British area contained three species, not two only. He arranged them as follows :—

Pleurobranchus (*Oscanius*) *membranaceus* (Montagu).
 „ (*Berthella*) *plumula* (Montagu).
 „ (*Bouvieria*) *perforata* Philippi.

The author of this paper first compared the descriptions of *plumula* and *perforata* in Engel's paper with such shells as were available at the time ; these included some from animals which had been examined and named by Engel. This alone caused one to suspect that Engel's *perforata* was the *plumula* of Montagu, while his *plumula* was an animal which up to then had not been recognized in this country, or, rather, perhaps one should say that its individuality had been swamped in what was really a description of two species by some of the earlier writers.

It seems that Vayssi re in working on the Pleurobranchid e identified a Mediterranean species wrongly as *plumula*. Engel in revising the group was biased by this, and overlooked the fact that it was known that *plumula* Vayssi re was quite different from *plumula* Montagu. Engel also had to depend upon spirit specimens, whereas the writer and many other observers in Britain have had the advantage of studying living animals. The following is a tabulation of the differences observed on examining shells named *perforata*

and *plumula* by Engel. The shells were first placed in a row with their ventral surfaces upwards, and the spire away from the observer.

plumula of Engel.
Cavity of the shell shallow.
Shoulder to right not angulated
and not tending to project beyond the spire.
Neither margin much curled inwards.
Lines of growth not very strongly marked, rather wrinkled near the edge.
Longitudinal folds from apex slight or absent.

perforata of Engel.
Cavity deeper.
This shoulder angulated, and projecting beyond the apex of the spire.
Margins slightly inflected.
More strongly marked and less wrinkled.
Folds more pronounced.

On placing the shells with the dorsal surface upwards the following points were noticed :—

Shell flatter.
Longitudinal folds less prominent.
Rather less iridescent.
Folds parallel to lines of growth inconspicuous.
Margins straight and parallel.
General aspect of the shell rather like *Limax* : a parallelogram with the corners rounded off.

Shell more convex.
Folds more prominent.
Very iridescent.
Folds more conspicuous specially near the periphery.
Margins slightly hollowed.
General aspect like *Testacella* at a casual glance.

I do not think that the colour is of great value in distinguishing the shells ; for instance, of two typical examples of *plumula* collected in Guernsey by Tomlin, one is white, the other a brownish horn colour.

The shells were then compared with the following drawings. The drawing of *plumula* Montagu in Sowerby's *Index* is exactly like the shells collected by the author of this paper at Oban, and named *perforata* by Engel. This is also true of the two figures in Jeffreys's *British Conchology*, pl. xcvi, especially of the one of the part of the shell showing the apex.

The description of *plumula* Montagu in Jeffreys (vol. 5, p. 12) is also far more that of Engel's *perforata* than his *plumula*. At the same time one is left with the impression that Jeffreys may have had shells of both kinds before him, but had failed to detect specific differences between them. Examples of this are noticed in the following : His remarks on the margin point to Engel's *perforata*. Those on colour are, if anything, in favour of *perforata*. His mention of the "slight furrow which runs from back to front" is characteristic of *perforata*. On the other hand, "squarish outline" alone is more correct for Engel's *plumula*.

The habits of *plumula* and *perforata* seem to be similar ; they are generally found between tide marks on the undersides of rather large stones. They may be found in such situations in spring, summer, and autumn. I have no first hand knowledge of their

habits in winter. They do not seem to be subject to the marked inshore migration in spring which I have remarked at Salcombe in the case of *Oscanius membranaceus* Montagu. I have some doubt as to whether *perforata* is commoner than *plumula*. Collecting from Oban to the Channel Islands has on the whole given me a different impression. It is now necessary to compare some other anatomical features, as well as the shell in the following animals. They are best tabulated :—

	Vayssière's description	Vayssière's description	Montagu's description
Vayssière's name .	<i>plumula</i> Montagu wrongly.	<i>perforata</i> Philippi.	<i>plumula</i> Montagu.
Proposed name .	<i>engeli</i> nov.	<i>plumula</i> Montagu.	
General colour .	Pale yellow, citron yellow, sometimes orange.	Iridescent, hyaline white, somewhat rosy or bluish over various internal organs.	Pale yellow above, yellowish white below.
Shell colour .	Roseate amber yellow, the rose especially at the circumference.	Milky white, somewhat rosy in some specimens, rather yellowish in others.	Yellowish white tinged with brown at one end.
Body .	Smooth when fresh, tuberculate in alcohol.	Reticulated.	Reticulated.
Shell shape .	Naticoid, growth lines fine, only visible with lens. Longitudinal striæ finer.	Ovoid, auricular, some growth lines strongly marked dorsally, less so ventrally. Numerous longitudinal striæ under × 10, which give iridescent effect by crossing growth lines.	Ovate, oblong, strongly wrinkled.
Radula .	Teeth shaped like knife-blade, saw-like in distal half.	Teeth hook-like.	
Mandibles .	Smooth.	Serrated margins.	
Plume .	Bipinnate, scarcely half length of body. 18 dorsal, 17 ventral pinnules (not alternate in fig.).	20 dorsal, 18 ventral pinnules, each itself bipinnate with about 12 little branches on each.	Pinnatifid, the pinnæ standing alternate (pinnules with lateral branches in figure).
Measurement of animal in mm.	20-29 × 10-15.	25-30 × 14-17.	Diam. nearly double shell.
Measurement of shell in mm.	4-7 × 2.6-4.5.	10-14 × 5.8-7.	½ in. × ¼ in. [i.e. 12.5 × 6]
Ratio of body length to shell length.	5 to 4.	2.5 to 2.2.	About 2.
Position of genital orifice.	From fig., a little in front of plume.	From fig., immediately adjacent to plume.	Plume immediately behind a protruded foramen.
Locality of specimens.	Marseilles.	Roscoff (Brittany).	Milton (Devon).
Distribution .	Mainly Mediterranean, also Norway, Hebrides, Devon, Guernsey.	Channel, West coast of France, Cete, Sicily.	

In the preceding comparison it will be seen that in Vayssière's diagnosis Montagu's *plumula* agrees with *perforata*, but not with *plumula* of Vayssière. The one exception to this is perhaps found in colour, but the author has found this to be very variable, so that this difference seems to be outweighed by the evidence in favour of *perforata* being *plumula* Montagu.

Montagu's figure, for example, does show the relative positions of the genital orifice and the branchial plume (a point also made

clear in Montagu's description). The figure also shows the markedly alternate arrangement of the pinnules, and also the well-developed lateral processes of each pinnule. This view is also supported by the size of the shell and its relative size to the rest of the animal. If, as I am firmly convinced is the case, *perforata* Philippi and *plumula* Montagu are the same animal, then Vayssi re's *plumula* is left without a name.

The plume characters and also those of the radula make it desirable to place the two species in different genera, or at all events in different sub-genera.

Now *Berthella* has as type *B. plumula* Montagu ; hence with the recognition of the identity of *plumula* Montagu and *perforata* Philippi, *Bouvieria* becomes a synonym of *Berthella*. *Cleanthus* Leach is also a synonym of *Berthella*, so that no generic name is available for the group *brocki* Vayss., *citrina* Leuck., *edwardsi* Vayss., *granulata* Krauss, and Engel's so-called *plumula*. For the *Pleurobranchus* (*Berthella*) *plumula* of Engel's paper I therefore propose the new name *Berthellina* with type species *engeli* nom. nov. (*Berthella plumula* of Vayssi re).

In conclusion I am convinced that Dr. Engel's identification of Montagu's *Bulla plumula* with Vayssi re's *Berthella plumula* is wrong. On all points of comparison, except colour, which is variable, Montagu's *plumula* agrees with Vayssi re's *perforata*, and not with his *plumula*. The drawing given by Montagu of the plume and genital orifice is convincing and supported by the writer's examination of actual specimens of both species, the names of which should be :—

Berthella plumula Montagu (= *perforata* Philippi of Vayssi re).

Berthellina engeli nov. (= *plumula* Vayssi re).

My thanks are due to Dr. E. J. Allen for a prompt response to my appeal for specimens, which included both the species under discussion.

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NERITINA FLUVIATILIS IN ORKNEY.

By A. E. BOYCOTT.

(Read before the Society 2nd November, 1935.)

IN England *Neritina* is not uncommon in running water from Somerset and Kent to North Lancashire and Yorkshire, and in Ireland in the central parts. It is unknown in Devon and Cornwall, in Wales except in Glamorgan, in the extreme north of England, and in the whole of Scotland except for an outlying locus round the junction between Stenness and Harray Lochs in Orkney, where it was discovered by Edward Forbes¹ about 100 years ago, more than 300 miles north of its nearest known station. As Forbes and Hanley² say: "The question of the parentage of the Orkney specimens is a curious subject for zoological speculation"; but however they got there they have since been found in abundance on many occasions, e.g. by J. McMurtrie,³ who remarks that "the shells are clean and beautifully marked", by T. Scott,⁴ by J. Waterston,⁵ by K. H. Jones⁶ about twenty years ago who found them "much eroded", and more recently by C. Oldham and J. R. le B. Tomlin this year. The English and Irish distribution seems to be determined by the need the species has for calcareous water: it has never been found in really soft water, as in Cornwall, North Wales, or the Lake District, and the least calcareous loci I know for it are the Herefordshire Wye, with about 20 mgms. calcium per litre (= 5 degrees of hardness), and the Lancashire Lune, with about 30; most of its habitats have 60-100. In Ireland Stelfox⁷ says it is strictly calcicole, and Moquin-Tandon⁸ that it lives in calcareous districts in France. The great majority of the water in the northern half of Scotland is soft and it is interesting to find that *Neritina* maintains its calcicole habit in Orkney which I have been able to do with the kind help of Mr. Robert Rendall, of Kirkwall, who got me three samples of water from different places in the *Neritina* neighbourhood near the Bridge of Brodgar. These gave 54, 85, and 96 mg. per litre of calcium, on the average 78 (= 20 degrees of hardness), so that the water is pretty well as hard as in the Thames and other *Neritina* habitats in the south of England. The samples were taken on an ebbing tide and were

¹ J. E. Gray's edition of W. Turton's *Manual L.F.W. Shells Brit. Isles*, 1840, p. 84.

² *Hist. Brit. Moll.*, 1853, vol. iii, p. 6.

³ In R. Rimmer, *L.F.W. Shells Brit. Isles*, 1880, p. 24.

⁴ *Annual Reports of the Fishery Board for Scotland*, 1891, part iii, p. 269.

⁵ *Ann. Scot. Nat. Hist.*, 1903, p. 52.

⁶ *Proc. Malac. Soc.*, 1919, vol. xiii, p. 151.

⁷ *Proc. Roy. Irish Acad.*, 1911, vol. xxix, B, p. 121.

⁸ *Hist. Nat. Moll. Terr. Flur. de France*, 1855, vol. ii, p. 548.

almost wholly freshwater, the salinity being only 0.2 per cent NaCl. It is a pleasure to vindicate the precision with which *Neritina* chooses the places where it cares to live: there cannot be many places in Scotland, especially in the northern parts, with hard water which is not too stagnant to satisfy it.



That the water is hard is not surprising. Underground water in Old Red Sandstone areas often, perhaps usually, contains much lime, and the lakes are no doubt charged by springs and seepage from the land as well as by surface streams. W. A. Caspari⁹ mentions a calcareous deposit in the Loch of Swannay, and the Geological Survey Memoir¹⁰ mentions much lime in the flagstones, wind-blown shell sand in several districts, and calcareous marls on the sites of former lakes; the springs, too, may deposit a calcareous tufa. Dr. W. B. Bannerman has also been good enough to tell me that all the deep and surface spring water in Orkney is very hard.

[In July, 1935, the fresh clean examples were all under stones and not abundant; most specimens were on pebbles and coated with a white limy deposit.—J. R. le B. T.]

⁹ *Bathymetrical Survey of the Scottish Fresh-water Lochs*, 1910, vol. i, p. 271.

¹⁰ G. V. Wilson, et al., *Geology of the Orkneys*, 1935.

DESCRIPTION OF A NEW SPECIES OF MACROCALLISTA.

By W. J. CLENCH and R. A. McLEAN.

(Read before the Society, 11th May, 1935.)

IN 1817 L. W. Dillwyn proposed the name *Venus pacifica* for a shell called *V. chinensis* by Chemnitz in 1795. The name *chinensis* was previously applied by Chemnitz in 1788 to another *Venus*. Neither name was binomial¹ so that Dillwyn was justified in proposing a new name. However, the name *pacifica* had been applied by Bolten in 1798 to *Venus plicata* Gmelin, 1791. There was no reason for this change by Bolten and consequently the name *Venus pacifica* Bolten must be listed as a synonym of *Venus plicata* Gmelin. This makes *Venus pacifica* Dillwyn a homonym of *V. pacifica* Bolten. Sowerby (1855, p. 624) changed the name *chinensis* to *sinensis*, on the basis that the latter as a classical term was to be preferred and described it in the genus *Cytheræa*. This name is not to be confused with *Cyclina sinensis* (Gmel.). The two have never been used together in the genus *Venus*. According to the zoological rules this change is not an emendation but the creation of a new name. Fortunately a name was needed so the above *sinensis* Sowerby can be accepted as a new name to replace *V. pacifica* Dillwyn, 1817, non Bolten, 1798.

Venus chinensis Chemnitz, 1795, *Conchyl. Cab.*, **11**, p. 227, t. 202, f. 1976. non *Venus chinensis* Chemnitz, 1788, *ibid.*, **10**, p. 356, t. 171, f. 1663.

Venus pacifica Dillwyn, 1817, *Descript. Cat. Recent Shells*, **1**, p. 175, non *Venus pacifica* Bolten, 1798, *Mus. Bolten.* p. 183.

Cytheræa sinensis Sowerby, 1855, *Thesaur. Conch.*, **2**, p. 624, pl. 131, f. 80-1.

Another change appears to be necessary. *Venus costata* Chemnitz, 1795, cannot stand, as Gmelin applied this name to another *Venus* in 1791, and also according to Sherborn (see footnote) this volume of Chemnitz is non-binomial. In either case a new name is necessary.

Venus costata Gmelin, 1791, [in] Linné, *Syst. Nat.*, ed. 13, **1**, p. 3291. non *Venus costata* Chemnitz, 1795, *Conchyl. Cab.*, **11**, p. 226, t. 202, f. 1975.

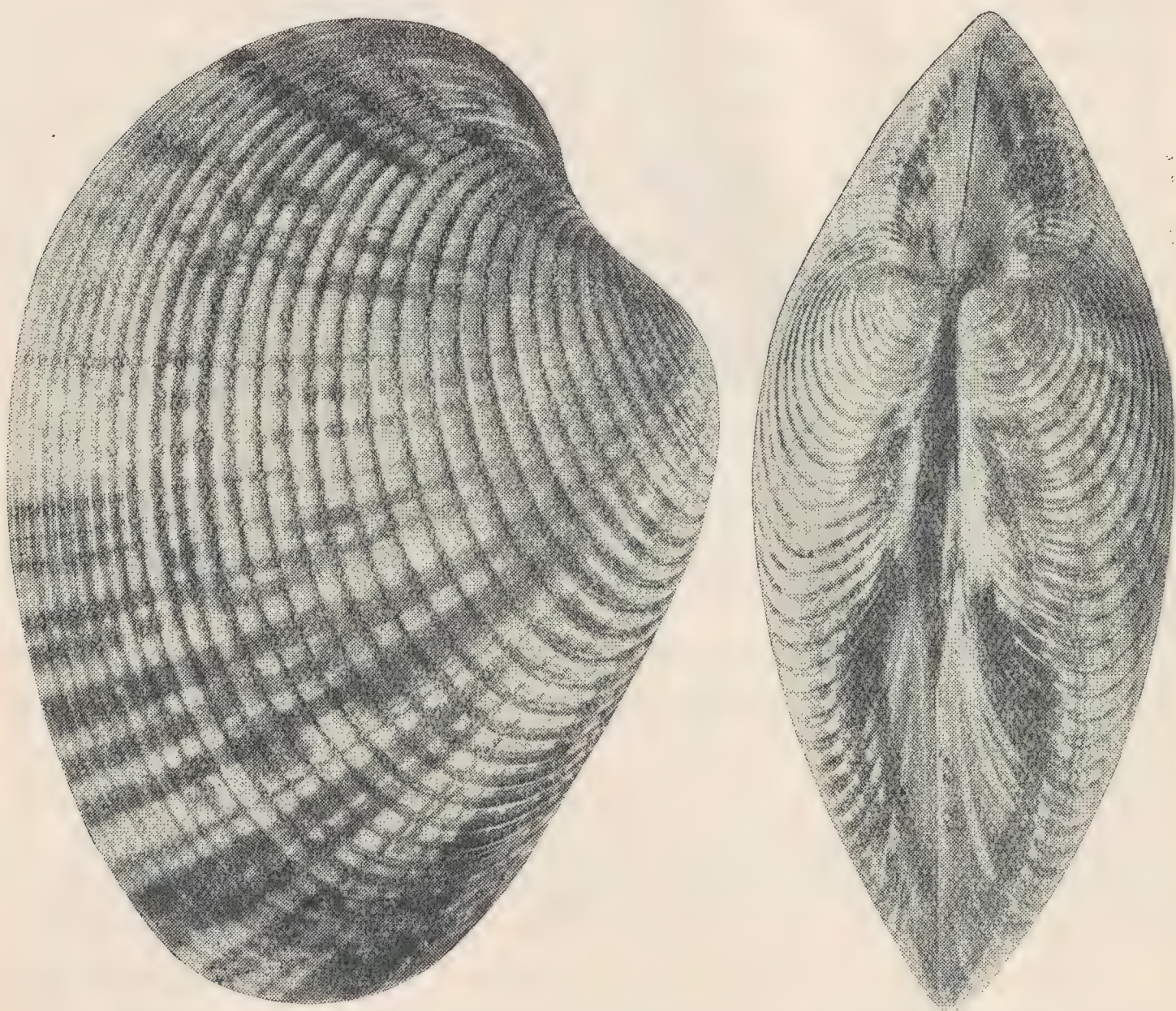
We suggest *Macrocallista* (*Paradione*) *nioba*, new name, to take the place of *Venus costata* Chemnitz, referring to the same figures as given by Chemnitz.

Dall (1902, p. 351) used *Chionella* Cossmann, 1886, as a section

¹ Sherborn, 1902, *Index Animalium*, pt. i, for the years 1758-1800, p. xxxvii of the bibliography, states in reference to Martini and Chemnitz, *Neues Syst. Conchyl. Cabinet*, "Last vol. only binomial." The last volume referred to is vol. xii, 1829.

of *Macrocallista*, to include the non-elongate forms of this genus. Later (1909, p. 197) he proposed the name *Paradione* to replace *Chionella* Cossmann, 1886, non Swainson, 1840. Iredale (1924, p. 210) proposed the name *Notocallista* for the Austral species in this genus, selecting *Macrocallista kingi* Gray as the genotype. His name is without question an absolute synonym of *Paradione* Dall.

We have received a series of shells from Western Australia that



appear close to *Macrocallista* (*Paradione*) *nioba*. The shells are more laterally compressed than in this latter species and differ consistently in colour.

MACROCALLISTA (PARADIONE) BARDWELLI, new species.

Shell rather oval, the diameter contained 2.4 times in the length. The sculpture consists of fairly heavy concentric ridges. The upper or umbonal sides of these ridges are nearly perpendicular, the lower or marginal sides slope at an angle of approximately 45 degrees. The entire outer surface of the valves is polished. Minute sculpture consists of very small radial striæ, limited to the lower posterior area of the valves. These minute striæ cross the concentric ridges at

right angles. The colour consists of a rich cream which shades into a pink at the margin of the shell in adult specimens. There are numerous radial bands and streaks of purplish brown which are paler toward the beaks. Lunule very broadly lanceolate, defined by slight grooves and coloured pinkish with a few irregular, chocolate brown, thread-like lines. Region of the area more intensely rayed ; escutcheon not defined. Interior white, sometimes with a tinge of pink in the cavities of young specimens. Pallial sinus somewhat pointed at the lower distal end and not quite reaching the mid-line.

<i>Length.</i>	<i>Height.</i>	<i>Width.</i>	
88 mm.	58 mm.	33 mm.	Holotype.
72 mm.	51 mm.	29 mm.	Paratype.
62.5 mm.	45.5 mm.	26.5 mm.	„
54 mm.	40 mm.	22 mm.	„
59 mm.	44 mm.	27 mm.	„

Holotype.—Mus. Comp. Zool. 92135, Broome, Western Australia, B. Bardwell collector. Paratypes from above locality collected by B. Bardwell and H. L. Clark, and from near Garden Island, Fremantle, Western Australia, by H. L. Clark. A single paratype deposited in the South Australian Museum.

Mr. B. C. Cotton, of the South Australian Museum, adds the following : Fremantle ; Yallingup, Geography Bay ; Albany ; all South-west Division ; and Esperance, Eucla Division. Esperance at about 122 degrees E. long. seems at present to be the eastern limit of this species so far as known.

Remarks.—The above species resembles *M. nioba* in shape and sculpture, but differs in colour, being darker, and in width as compared to length. In *M. nioba* the width will go 1.9 times into the length. *M. bardwelli* resembles *M. erycina* somewhat in coloration and general appearance, but the coloration of *M. bardwelli* is darker and the concentric ridges of this species are more convex and evenly spaced. The ridges of *M. erycina* tend to be a little irregular and are quite wide and flattened. Our present new species is probably the one figured by Sowerby (1855, *Thes. Conch.*, ii, p. 623, pl. 130, f. 71) as *Cytheræa costata* var. *pacifica* Dillw. but his figure is very much foreshortened and no accurate idea of the shape of the shell can be obtained from it. Another species that resembles *M. bardwelli* in coloration and gross external appearance is *Cytheræa hagenowi* Dunker, described from the Red Sea. The ratio, for this species, of length to width is 2.1 to 1.0. According to the figures that we have seen *C. hagenowi* Dunker is a less elongate form than our present new species, and possesses as well a truncated posterior end. Our new form has the posterior end smoothly rounded.

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STUDIES OF AFRICAN LAND AND FRESH-WATER MOLLUSKS.

Notes on *Edentulina* Pfeiffer, with Descriptions of New Species.

By JOSEPH BEQUAERT¹ and WILLIAM J. CLENCH.²

(Read before the Society 11th May, 1935.)

[PLATE 8.]

THE species described in this paper were recognized as new some time ago and, since duplicates of some of them have been distributed, their names should be rendered valid without further delay. The opportunity is used to present a synopsis of *Edentulina*.

Edentulina Pfeiffer.

Ennea subgenus *Edentulina* Pfeiffer, 1856 (January), *Malak. Blätter*, ii (1855), p. 173.

Type by designation of Kobelt, 1904, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. 1, p. 290: *Bulimus ovoideus* Bruguière, 1789.

It may be noted that most species of *Edentulina* have an impressed line a short distance below and parallel with the suture. In *Gonaxis* and *Marconia*, on the other hand, the whorls are crenulated or beaded below the suture.

The genus is exclusively African, containing the species listed below. Other species, included by Tryon (1885), Bourguignat (1889), and Kobelt (1904), do not belong here.

affinis C. R. Boettger, 1913; with var. *gracilis* C. R. Boettger, 1913.—Tanganyika Territory.

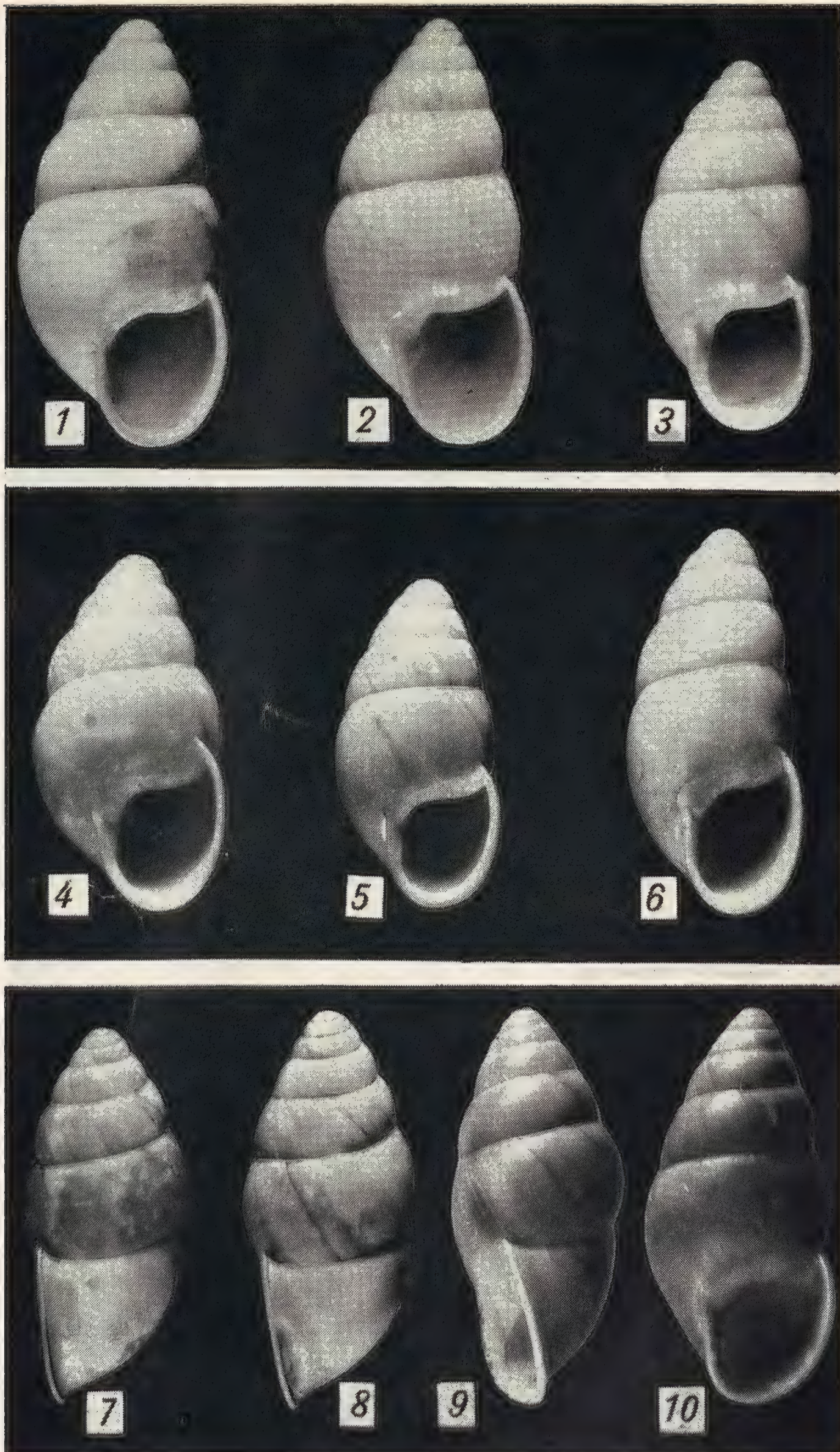
dussumieri (Dufo, 1840).—Seychelles, Madagascar?).

grandis (Pfeiffer, 1846).—Socotra.

insignis (Pfeiffer, 1857).—Gaboön, Cameroon.

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Figs. 1-8: *Edentulina affinis* C. R. Boettger.
Amani. Natural Size.

Figs. 9 and 10: *Edentulina ovoidea* (Bruguière).
Mayotte. Natural size.

intermedia (Morelet, 1851).—Madagascar.

johnstoni (E. A. Smith, 1887).—Cameroon.

langiana Pilsbry, 1919.—Belgian Congo.

liberiana (Lea, 1840). Syn. : *pupulus* Morelet, 1848.—Liberia.

martensi (E. A. Smith, 1882); with var. *subumbilicata* (O. Boettger, 1905), and form *minor* (d'Ailly, 1896).—Cameroon.

obesa (Taylor, 1877). Syn. : *zanguebarica* Morelet, 1889. With var. *bulimiformis* (Grandidier, 1887): Syn. *grandidieri* Bourguignat, 1889.—Tanganyika Territory, Kenya Colony, Zanzibar.

oleacea (Fulton, 1903).—Tanganyika Territory.

ovoidea (Bruguière, 1789). Syn. : *tumida* Morelet, 1860; *ovoidea* var. *mayottensis* Dupuis and Putzeys, 1901; *Bulimus grandis* Deshayes, 1851.—Comoros.

stumpffii Kobelt, 1904.—Madagascar.

ulugurensis Bequaert and Clench, 1935.—Tanganyika Territory.

usambarensis Bequaert and Clench, 1935.—Tanganyika Territory.

We have seen specimens of all, except *intermedia*, *johnstoni*, and *stumpffii*.

***Edentulina affinis* C. R. Boettger.**

Plate 8, Figs. 1 to 8.

Edentulina affinis C. R. Boettger, 1913, *Proc. Mal. Soc. London*, x, pt. 6, p. 349, pl. xv, fig. 8 (Kipatimu, Tanganyika Territory).

Edentulina affinis var. *gracilis* C. R. Boettger, 1913, loc. cit., p. 349, pl. xv, fig. 9 (Kipatimu, Tanganyika Territory).

Bulimus ovoideus Woodward, 1859, *Proc. Zool. Soc. London*, p. 350 (Kilwa [= Kilwa], 9° S., 39° to 40° E., Tanganyika Territory). Craven, 1880, *Proc. Zool. Soc. London*, p. 217 (Magila in Usambara, Tanganyika Territory). Not of Bruguière, 1789.

Edentulina ovoidea Bourguignat, 1889, *Moll. Afr. Equat.*, p. 140 (in part; specimens from Mt. Nguru, Usagara, 2,000 m., Tanganyika Territory). Kobelt, 1904, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. 1, p. 290 (in part), pl. xxxiv, figs. 5-7 (specimens from Tanganyika Territory).

Ennea ovoidea E. v. Martens, 1897, *Mitt. Naturh. Mus. Hamburg*, xiv, p. 113.

Ennea (Edentulina) ovoidea E. v. Martens, 1897, *Deutsch. Ost-Afr.*, iv, *Besch. Weichth.*, p. 11, pl. ii, figs. 11-13 (Mt. Miassa at Derema in the Handei Mts., Usambara, 1,000 m.; Kitohau, 26 kilom. south-west of Sadi Mankanjila, on the plateau between Ukuledi and Umbekuru; both localities in Tanganyika Territory). Germain, 1916, *Bull. Mus. Hist. Nat. Paris*, xxii, p. 244 (Kipatimu, Tanganyika Territory).

Tanganyika Territory: Bagilo, Uluguru Mts., 5,000 feet; Vituri, Uluguru Mts., 2,500 feet; Nyange, Uluguru Mts., 3,000 feet

(A. Loveridge). Amani, Usambara Mts., 3,000 feet (A. Loveridge and R. E. Moreau). Kizerui, Usambara Mts., 4,000 feet (A. Loveridge).

We have seen in all nineteen full-grown specimens of this species which appears to be common in the forested mountain ranges a short distance from the coast in Tanganyika Territory. All large *Edentulinae* seen from that territory are *E. affinis*, and we have reached the conclusion that those recorded from the same district by Woodward, Craven, Bourguignat, E. v. Martens, and Germain were also Boettger's species and not *E. ovoidea*. When compared with specimens of true *ovoidea*, *E. affinis* shows the following distinctive features: The shell is only very slightly flattened on the apertural face, so that in profile the axis of the spire runs near the middle of the shell; the lower edge of the aperture is evenly curved, not in the least sigmoid seen in profile; and the base of the last whorl is strongly convex, saccate. The sculpture is the same in both *ovoidea* and *affinis* and the convexity of the whorls and perforation of the columella show no very striking differences.

Size and shape vary greatly, as pointed out by E. v. Martens and as shown by our figures of eight specimens from Amani. The total length ranges from 32 to 46 mm., the greatest width from 16.5 to 22 mm. Fig. 6 is the slender form called var. *gracilis* by C. R. Boettger, but it hardly deserves a name.

***Edentulina langiana* Pilsbry.**

Edentulina langiana Pilsbry, 1919, *Bull. Amer. Mus. Nat. Hist.*, xl, p. 171, fig. 60 (Stanleyville, Belgian Congo).

Ennea (Edentulina) ovoidea Dupuis and Putzeys, 1901, *Ann. Soc. Malac. Belgique*, xxxvi, *Bull. Séances*, p. lix (Nsendwe, Belgian Congo). Not of Bruguière.

Belgian Congo: Stanleyville, one specimen. Katombe, Lower Katanga, one specimen (Michael Bequaert).

This species is extremely close to the East African *E. affinis* C. R. Boettger, with which it agrees in the saccate base, the shape of the lower edge of the aperture, and the very slight flattening of the apertural face of the shell. It differs in being thinner, with a much shorter and broader aperture, a thinner and more narrowly reflected lip, and a longer and deeper umbilical crevice.

***Edentulina ovoidea* (Bruguière).**

Plate 8, Figs. 9 and 10.

Bulimus ovoideus Bruguière, 1789, *Encyclop. Méthod.*, Vers, i, pt. 1, p. 335 (no locality). Shuttleworth, 1848, *Zeitschr. f. Malakoz.*, v, p. 79. Pfeiffer, 1848, *Monogr. Helic. Viv.*, ii, p. 45.

Ennea (Edentulina) ovoidea Pfeiffer, 1856 (January), *Malak. Blätter*, ii (1855), p. 173; 1859, *Monogr. Helic. Viv.*, iv, p. 335; 1868, loc. cit., v, p. 451; 1876, loc. cit., vii, p. 498.

Ennea ovoidea Morelet, 1860, *Séries Conchyl.*, ii, p. 74 (Mayotte at about 1,200 m.); 1877, *Jl. de Conchyl.*, xxv, p. 336 (Anjouan); 1883, loc. cit., xxxi, p. 197 (Mayotte). Crosse and Fischer, 1889, in Grandidier, *Hist. Phys. Madagascar*, xxv, *Hist. Moll.*, pt. 1, Atlas, pl. xxiii, figs. 2-2a.

Gibbus (Edentulina) ovoideus Tryon, 1885, *Man. of Conch.* (2), i, p. 82, pl. xvii, fig. 18.

Edentulina ovoidea Bourguignat, 1889, *Moll. Afr. Equat.*, p. 140 (in part). Kobelt, 1904, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. 1, p. 290, pl. xxxiv, figs. 1-4 (two specimens from Mayotte); 1910, *Jahrb. Nassau. Ver. Naturk. Wiesbaden*, lxiii, p. 167. Haas, 1929, *Zool. Jahrb., Abt. Syst.*, lvii, p. 395 (Mayotte).

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Ennea tumida Morelet, 1860, *Séries Conchyl.*, ii, p. 75, pl. v, fig. 7 (locality unknown).

Gibbus (Edentulina) tumidus Tryon, 1885, *Man. of Conch.* (2), i, p. 83, pl. xvii, fig. 19.

Edentulina tumida Bourguignat, 1889, *Moll. Afr. Equat.*, p. 140 ("Mayotte," here given as locality, appears to be a mere surmise). Kobelt, 1904, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. 1, p. 292, pl. xxxiv, fig. 8.

We have seen two specimens which we regard as true *ovoidea*: one from an unknown locality, the other from Mayotte. They differ from *E. affinis* as follows: the shell is much flattened on the apertural face, so that in profile the axis of the spire runs much closer to the apertural face than to the strongly convex opposite face; the lower edge of the aperture is curved backward, making the lip strongly sigmoid in profile; and the base of the last whorl is tapering, not convex. Our two specimens measure respectively 48.5 and 47.5 mm. in length, 22.6 and 22.5 mm. in greatest width.

E. ovoidea is known with certainty from the Comoros only, where it appears to be common. Published records from "Madagascar" seem to be all unreliable.

***Edentulina grandis* (Pfeiffer).**

Pupa grandis Pfeiffer, 1846, *Symb. Hist. Helic.*, iii, p. 95 (Socotra). Philippi, 1847, *Abb. Beschr. Conch.*, ii, p. 156 (p. 26 of *Bulimus*),

pl. *Bulimus vi* (xxxi), figs. 4 (type). Pfeiffer, 1848, *Monogr. Helic. Viv.*, ii, p. 301. Küster, 1852, *Syst. Conch.-Cab.*, i, Abt. 15, p. 120, pl. xvi, figs. 2-3. E. v. Martens, 1897, *Deutsch. Ost-Afr.*, iv, *Besch. Weichthiere*, p. 12.

Ennea ovoidea Crosse, 1884, *Jl. de Conchyl.*, xxxii, p. 357 (Socotra). Not of Bruguière.

Following Shuttleworth's suggestion (1848, *Zeitschr. f. Malakoz.* v, p. 79), Pfeiffer and others regarded *Pupa grandis* as identical with *Bulimus ovoideus* Bruguière. E. v. Martens seems to have been doubtful about the matter, which he left undecided.

Two specimens, presumably from Socotra, at the Museum of Comparative Zoology, agree with *E. ovoidea* in the sigmoid curve of the lower edge of the aperture and in the shell being somewhat flattened on the apertural face. They differ, however, in the much more open and deeper umbilicus (in *ovoidea* this forms a closed slit). We are provisionally regarding them as specifically distinct from *ovoidea*, even though recent collectors have failed to find *Edentulina* in Socotra. Deshayes' *Bulimus grandis* was, we believe, *E. ovoidea*.

***Edentulina dussumieri* (Dufo).**

Puppa dussumieri "Férussac" Dufo, 1840, *Ann. Sci. Nat., Zool.* (2), xiv, p. 198 (Mahé, Seychelles; with brief description of a young shell).

Bulimus dussumieri Reeve, 1849, *Conch. Icon.*, v, *Bulimus*, pl. lxxv, fig. 457 (supposedly from "India"). Pfeiffer, 1853, *Monogr. Helic. Viv.*, iii, p. 362.

Pupa (Gibbulina) dussumieri Pfeiffer, 1856 (January), *Malak. Blätter*, ii (1855), p. 174; 1859, *Monogr. Helic. Viv.*, iv, p. 661.

Ennea dussumieri Morelet, 1860, *Séries Conchyl.*, ii, p. 79, pl. v, fig. 8 (figures a specimen from the Seychelles in Férussac's collection; claims it occurs also in Madagascar). Crosse and Fischer, 1889, in Grandidier, *Hist. Phys. Madagascar*, xxv, *Hist. Moll.*, pt. 1, Atlas, pl. xxiii, figs. 6-6a. Sykes, 1909, *Trans. Linn. Soc. London, Zool.* (2), xiii, pt. 1, p. 59 (Mahé; Silhouette; Praslin).

Gibbus (Gibbulina) dussumieri Nevill, 1868, *Proc. Zool. Soc. London*, p. 260 (Mahé; Praslin; Silhouette; Félicité; all Seychelles).

Gibbus dussumieri Tryon, 1885, *Man. of Conch.* (2), i, p. 84, pl. xvii, fig. 38.

Ennea dussimieri Paetel, 1873, *Cat. Conch.-Samml.*, p. 83.

Ennea (Edentulina) dussumieri Pfeiffer, 1868, *Monogr. Helic. Viv.*, v, p. 452; 1876, loc. cit., vii, p. 499. E. v. Martens, 1898, *Mitt. Zool. Mus. Berlin*, i, pt. 1, p. 7, pl. i, figs. 7-10, 10a-d (Mahé; Silhouette). Wiegmann, 1898, loc. cit., p. 38, pl. iii, figs. 1, 2, 5, 7, 8; pl. iv, figs. 2-3 (anatomy).

Edentulina dussumieri Kobelt, 1904, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. 1, p. 298, pl. xxxiii, fig. 6-8.

We have seen many specimens from the Seychelles, some of them from Mahè. There is no definite record of the occurrence of this species in Madagascar or elsewhere.

***Edentulina intermedia* (Morelet).**

Pupa intermedia Morelet, 1851, *Rev. Mag. Zool.* (2), iii, p. 220 (Port Léven, Madagascar). Pfeiffer, 1853, *Monogr. Helic. Viv.*, iii, p. 529.

Ennea intermedia Morelet, 1860, *Séries Conchyl.*, ii, p. 76, pl. v, fig. 6 (type). Crosse and Fischer, 1889, in Grandidier, *Hist. Phys. Madagascar*, xxv, *Hist. Moll.*, pt. 1, Atlas, pl. xxiii, fig. 3.

Ennea (Edentulina) intermedia Pfeiffer, 1859, *Monogr. Helic. Viv.*, iv, p. 335 ; 1868, loc. cit., v, p. 451 ; 1876, loc. cit., vii, p. 498.

Gibbus (Edentulina) intermedius Tryon, 1885, *Man. of Conch.* (2), i, p. 83, pl. xvii, fig. 20 (only).

Edentulina intermedia Bourguignat, 1889, *Moll. Afr. Equat.*, p. 140. Kobelt, 1904, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. 1, p. 292, pl. xxxiv, fig. 9.

According to the published figure this large species (41 mm. by 19 mm.) differs conspicuously from *E. affinis* and *E. ovoidea* in the shape of the aperture, which is obliquely semi-ovate.

***Edentulina stumpffii* Kobelt.**

Edentulina stumpffii Kobelt, 1904, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. 1, p. 294, pl. xxxv, figs. 6-7 (Nossi-Bé).

Ennea intermedia var. ? Kobelt, 1880, *Jahrb. D. Mal. Ges.*, vii, p. 333, pl. viii, figs. 4-7. Not of Morelet, 1851.

Ennea intermedia Crosse, 1881, *Jl. de Conchyl.*, xxix, p. 193 (Nossi-Bé). Not of Morelet, 1851.

Gibbus (Edentulina) intermedius Tryon, 1885, *Man. of Conch.* (2), i, p. 83, pl. xvii, figs. 22-3 (only).

This species is known with certainty from Nossi-Bé only. There is a possibility that it might be a *Gibbus*. Haas refers doubtfully to it a young specimen from Majunga, Madagascar (1929, *Zool. Jahrb., Abt. Syst.*, lvii, p. 405).

***Edentulina insignis* (Pfeiffer).**

Ennea insignis Pfeiffer, 1857, *Proc. Zool. Soc. London* (1856), p. 388 (Gaboon) ; 1858, *Novit. Conchol.*, i, p. 112, pl. xxxii, figs. 1-2 (type) ; 1859, *Monogr. Helic. Viv.*, iv, p. 335 ; 1868, loc. cit., v, p. 451 ; 1876, loc. cit., vii, p. 498.

Gibbus (Edentulina) insignis Tryon, 1885, *Man. of Conch.* (2), i, p. 83, pl. xvii, fig. 16.

Edentulina insignis Bourguignat, 1889, *Moll. Afr. quat.*, p. 140. E. Kobelt, 1904, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. i, p. 293, pl. xxxv, figs. 1-2. Degner, 1934, *Zool. Jahrb., Abt. Syst.*, lxxv, p. 232, fig. 15 (anatomy; Buea, Cameroon).

Gibbus insignis d'Ailly, 1896, *Bih. Svenska Vet.-Akad. Handl.*, xxii, Afd. iv, No. 2, p. 8 (Etome and Boana, Cameroon). O. Boettger, 1905, *Nachrichtsbl. D. Malak. Ges.*, xxxvii, p. 157 (Buea and interior of Cameroon).

Cameroon: Buea; Sakbayeme near Edea; Kribi; several specimens. We have also seen a specimen from the Gaboon.

***Edentulina johnstoni* (E. A. Smith).**

Gibbus (Edentulina) johnstoni E. A. Smith, 1887, *Proc. Zool. Soc. London*, p. 127, fig. (type, on p. 128; Mt. Cameroon, 7,000-8,000 feet, Cameroon).

Gibbus johnstoni O. Boettger, 1905, *Nachrichtsbl. D. Malak. Ges.*, xxxvii, p. 158 (Mt. Cameroon).

Edentulina johnstoni Kobelt, 1904, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. 1, p. 297, pl. xxxv, fig. 10.

Edentulina (?) johnstoni Degner, 1934, *Zool. Jahrb., Abt. Syst.*, lxxv, p. 233, fig. 16 (anatomy of immature snail from Buea, Cameroon).

This species is known from the Cameroon only, where it appears to be rare.

***Edentulina martensi* (E. A. Smith).**

Ennea (Edentulina) martensi E. A. Smith, 1882, *Jl. of Conch.*, iii, pt. 10, p. 301 (West Africa, without more definite locality; also based in part on v. Martens' pl. iv, figs. 1-1a, of 1878, of a Cameroon shell).

Gibbus (Edentulina) martensi Tryon, 1885, *Man. of Conch.* (2), i, p. 83, pl. xvii, fig. 17.

Gibbus martensi d'Ailly, 1896, *Bih. Svenska Vet.-Akad. Handl.*, xxii, Afd. iv, No. 2, p. 9 (Etome and Bomana, Cameroon; with var. *minor*, p. 9). O. Boettger, 1905, *Nachrichtsbl. D. Malak. Ges.*, xxxvii, p. 157 (Buea; Bomana, 800 m., Mt. Cameroon; Bakossi Mts., above 1,000 m.; all Cameroon).

Edentulina martensi Kobelt, 1904, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. i, p. 293, pl. xxxv, figs. 3-5. Odhner, 1932, *Proc. Mal. Soc. London*, xx, pt. 1, p. 20, figs. 2, 6, 7 (anatomy). Degner, 1934, *Zool. Jahrb., Abt. Syst.*, lxxv, p. 230, figs. 13-14 (anatomy; Buea, Cameroon). Spence, 1925, *Jl. of Conch.*, xvii, pt. 8, p. 248 (Buenga, Cameroon).

Marconia martensi Odhner, 1931, *Ark. f. Zool.*, xxiii, A, No. 14, p. 73 (radula).

Ennea insignis E. v. Martens, 1876, *Monatsber. Ak. Wiss. Berlin*, p. 263, pl. iv, figs. 1-1a (Victoria and Bonjongo, Cameroon). G. Pfeffer, 1878, *Jahrb. D. Malak. Ges.*, v, pp. 62-8, figs. i-v (anatomy). Not of Pfeffer.

We have studied three specimens from Etome, Cameroon, part of a lot recorded by d'Ailly.

***E. martensi* var. *subumbilicata* (O. Boettger).**

Gibbus martensi var. *subumbilicata* O. Boettger, 1905, *Nachrichtsbl. D. Malak. Ges.*, xxxvii, p. 157, fig. 1 (Nongo madiba on the Bali road, Cameroon).

Edentulina martensi subumbilicata Kobelt, 1904, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. 2, p. 172, pl. lxiv, figs. 1-3.

It is not impossible that this form may prove to be specifically distinct.

***Edentulina obesa* (Taylor).**

Ennea minor (?) E. v. Martens, 1869, in van der Decken's *Reisen in Ost-Afrika*, iii, Abt. i, p. 59 (no locality). Not of Morelet, 1851.

Buliminus obesus "Gibbons" Taylor, 1877, *Quart. J. Conch.*, i, pt. 12, p. 255, pl. ii, fig. 3 (Bawri or Bawi Island, Zanzibar).

Bulimus obesus Craven, 1880, *Proc. Zool. Soc. London*, p. 217 (Magila in Usambara; Pangani; both Tanganyika Territory).

Ennea obesa E. A. Smith, 1881, *Proc. Zool. Soc. London*, p. 281 (near Lake Nyasa and between it and Daressalaam, Tanganyika Territory). E. v. Martens, 1891, *Sitzungsber. Ges. Naturf. Fr. Berlin*, p. 16 (Kisemo in Ukuere, Tanganyika Territory). E. A. Smith, 1894, *Proc. Mal. Soc. London*, i, pt. 4, p. 166 (Witu and Mangea, Kenya Colony). E. v. Martens, 1897, *Mitt. Naturh. Mus. Hamburg*, xiv, p. 113 (Pangani).

Gibbus (Edentulina) obesus Tryon, 1885, *Man. of Conch.* (2), i, p. 83, pl. xvii, fig. 21.

Ennea (Edentulina) obesa E. v. Martens, 1897, *Deutsch. Ost-Afr.*, iv, *Besch. Weichth.*, p. 13 (Derema in Usambara; Masai Steppe at Pangani R.; both Tanganyika Territory). Germain, 1916, *Bull. Mus. Hist. Nat. Paris*, xxii, p. 245 (Kipatimu, Tanganyika Territory).

Edentulina obesa Bourguignat, 1889, *Moll. Afr. Equat.*, p. 141 (Malindi and Mombasa, Kenya Colony; Tanga; Quiryana and Nguru Mts., Tanganyika Territory). Kobelt, 1904, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. 1, p. 302, pl. xxxvi, figs. 11-12.

Ennea zanguebarica Morelet, 1889, *Jl. de Conchyl.*, xxxvii, p. 10, pl. i, figs. 7-7a (no locality mentioned, but presumably from "Zanguebar" or the coastal region of Tanganyika Territory).

Edentulina zanguebarica Kobelt, 1904, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. 1, p. 303, pl. xxxv, fig. 15.

Kenya Colony : Mt. Mbololo, Taita Mountains, 10 miles from Voi (A. Loveridge, 1934). Summit of Mt. Umengo, 13th November, 1911 (E. Heller, Rainey Exp.). Tanganyika Territory : Nyange, Uluguru Mts., 3,000 ft. (A. Loveridge, 1926). Zanzibar Island.

From the description and figure *E. zanguebarica* is indistinguishable from typical *obesa*. E. A. Smith (1894) reached the same conclusion. He also synonymized *E. bulimiformis* Grandidier and *E. grandidieri* Bourguignat, but we believe these two names refer to a form sufficiently distinct to be given at least varietal rank. Dautzenberg (1908) also pointed out that *grandidieri* differs from *obesa*.

Our specimens vary in length from 21.5 to 31.6 mm. and in greatest diameter from 10.7 to 14.3 mm.

***E. obesa* var. *bulimiformis* (Grandidier).**

Ennea (*Edentulina*) *bulimiformis* Grandidier, 1887, *Bull. Soc. Malac. France*, iv, p. 188 (mountains between the Usagara and Usegua districts, Tanganyika Territory).

Edentulina bulimiformis Bourguignat, 1889, *Moll. Afr. Equat.*, p. 141.

Ennea (*Edentulina*) *obesa* var. *bulimiformis* E. v. Martens, 1897, *Deutsch. Ost-Afr.*, iv, *Besch. Weichth.*, p. 13 (Tegetoro in Uluguru, 1,100 m.; Mbagalala in Uluguru; Magila in Usambara; all Tanganyika Territory).

Edentulina grandidieri Bourguignat, 1889, *Moll. Afr. Equat.*, p. 142, pl. vii, figs. 8-9 (Nguru Mt. in northern Usagara, 2,000 m.; Tanganyika Territory). Kobelt, 1906, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. 2, p. 171, pl. lxxv, figs. 6-7.

Ennea (*Edentulina*) *grandidieri* E. v. Martens, 1897, *Deutsch. Ost-Afr.*, iv, *Besch. Weichth.*, p. 13. Dautzenberg, 1908, *Jl. de Conchyl.*, lvi, p. 2 (Voi, Kenya Colony).

Kenya Colony : Voi (A. Loveridge, 1934).

Both *bulimiformis* and *grandidieri* appear to have been based upon a variation of *E. obesa* with the aperture narrower than usual. Grandidier's measurements of *bulimiformis* are : length, 27 mm.; width, 12 mm.; aperture, 11 by 7 mm.; and Bourguignat's of *grandidieri* : length, 28 mm. (given by error in the text as 18 mm.; the figure measures 28 mm.); width, 11 mm.; aperture, 11 by 7 mm. One shell from Voi has a decidedly narrower aperture than the other specimens of *obesa* we have seen. It measures : length, 16 mm.; greatest diameter, 12 mm.; aperture, 10.7 by 7 mm.

***Edentulina oleacea* (Fulton).**

Ennea oleacea Fulton, 1903, *Jl. of Malacology*, x, pt. 3, p. 99, pl. ix, fig. 9 (Ukumi, Tanganyika Territory).

Edentulina oleacea Kobelt, 1904, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. 1, p. 308.

Tanganyika Territory : Amani, Usambara District, 3,000 feet, three full-grown specimens (R. E. Moreau).

The species is allied to *E. obesa* (Taylor), but amply distinct.

***Edentulina ulugurensis*, new species.**

Figs. 11 and 12.

Description.—Shell convexly conic, thin, rimately perforate, not appreciably flattened dorso-ventrally and with a pronounced hump-like swelling on the body whorl above the aperture ; the base strongly convex or sack-like. Colour of periostracum light straw yellow, the shell itself a pure white. Whorls $6\frac{1}{2}$, rather convex.



Figs. 11 and 12 : *Edentulina ulugurensis* Bequaert and Clench. Vituri. Slightly less than natural size. Holotype.

Fig. 13 : *Edentulina usambarensis* Bequaert and Clench. Lutindi. $\times 2$ Holotype.

regularly increasing in width, the body whorl two-thirds of the length of the shell. Spire acute as a whole, produced at an angle of 67° from the base line, the summit obtuse because of the flattened first two whorls. Aperture subquadrate, its outer and inner sides parallel and somewhat oblique to the axis of the shell. Outer lip white, narrow, and very slightly reflected, scarcely ascending at the suture ; in profile the edge is straight and cast obliquely from the axis. Columella nearly straight, somewhat thickened and folded above over the umbilical rimation ; the umbilicus is definitely open when viewed at an angle and only appears to be rimate when viewed from below. Suture not deeply impressed, not crenulated, but margined by an impressed line along the inferior border. Sculpture : first two whorls smooth ; following whorls with an exceedingly fine and close axial striation, which is somewhat interrupted by areas of fine malleation ; the malleation is especially distinct below the suture, where the shell is almost microscopically beaded ; ventral

surface of body whorl and area immediately behind the outer lip almost devoid of sculpture.

MEASUREMENTS.

Length	Greater Diameter	Lesser Diameter	Aperture	
29.2 mm.	17.5 mm.	15.5 mm.	11.5 by 9.1 mm.	Holotype

Holotype.—Museum of Comparative Zoology, No. 59926, Vituri, Uluguru Mountains, 2,500 feet, Tanganyika Territory (Arthur Loveridge, 1926).

Remarks.—The swelling on the body whorl is the most striking feature of this species. This character is also found in *Marconia gibbosa* Bourguignat (1889, *Moll. Afr. Equat.*, p. 137, pl. vii, figs. 6–7), also of Tanganyika Territory. Our species is, however, not related to *gibbosa*, which seems to be a *Gonaxis* (as suggested by Gude, 1902, *Proc. Mal. Soc. London*, v, pt. 3, p. 205), 14 mm. in length, and with a strongly crenulated suture.¹ We were at first inclined to regard the gibbosity of our species as an abnormal feature, but the shell seems to be otherwise normal. Moreover, it differs from its nearest relatives also in other respects. The much shorter and broader aperture separates it from *E. affinis*, *E. obesa*, and *E. oleacea*; in addition *affinis* and *oleacea* have a closed umbilicus, while in *oleacea* the axial striation is much more pronounced and in *obesa* the whorls are more convex and the summit more pointed. *E. ulugurensis* has a thinner and less reflected outer lip and a much finer sculpture than *affinis*.

Edentulina liberiana (Lea)

Bulimus liberianus Is. Lea, 1840, *Proc. Amer. Phil. Soc.*, i, p. 174 (Liberia); 1841, *Trans. Amer. Phil. Soc.*, N.S., vii, p. 457, pl. xi, fig. 4 (type). Pfeiffer, 1848, *Monogr. Helic. Viv.*, ii, p. 116; 1853, loc. cit., iii, p. 359. Reeve, 1850, *Conch. Icon.*, v, *Bulimus*, pl. lxxxviii, fig. 660.

Ennea (*Edentulina*) *liberiana* Pfeiffer, 1859, *Monogr. Helic. Viv.*, iv, p. 336; 1868, loc. cit., v, p. 451; 1876, loc. cit., vii, p. 499.

Ennea liberiana Dohrn, 1875, *Malak. Blätter*, xxii, p. 205; 1878, *Jahrb. D. Mal. Ges.*, v, p. 154 (living animal grass green). E. v. Martens, 1891, *Sitzungsber. Ges. Naturf. Fr. Berlin*, p. 30 (Barombi, Cameroon). Johnston, 1906, *Liberia*, ii, p. 861.

¹ The name *Gonaxis gibbosa* (Bourguignat) need not be replaced by *Gonaxis marconi* (Gude), since the South American *Streptaxis gibbosa* Pfeiffer was not originally described as a *Gonaxis* and is not now included in that genus.

Gibbus (Edentulina) liberianus Tryon, 1885, *Man. of Conch.* (2), i, p. 83, pl. xvii, fig. 26.

Edentulina liberiana Bourguignat, 1889, *Moll. Afr. Equat.*, p. 141, Kobelt, 1904, *Syst. Conch.-Cab.*, i, Abt. 12B, pt. 1, p. 297, pl. xxxv, fig. 11. Conolly, 1928, *Ann. Mag. Nat. Hist.* (10), i, p. 529 (Kaiyima, Sandoh Chiefdom, Sierra Leone). Spence, 1928, *Jl. of Conch.*, xviii, pt. 7, p. 211 (Ferme Suisse near Edea, Cameroon). Degner, 1934, *Zool. Jahrb., Abt. Syst.*, lxxv, p. 228, fig. 12 (anatomy; Gbandevulo, Sierra Leone).

Gibbus liberianus d'Ailly, 1896, *Bih. Svenska Vet. Akad. Handl.*, xxii, Afd. iv, No. 2, p. 7 (Etome; Itoki; Ndian; Bonge; Kitta; Bibundi; all in Cameroon). A. de Rochebrune, 1898, *Bull. Mus. Hist. Nat. Paris*, iv, p. 157. O. Boettger, 1905, *Nachrichtsbl. D. Malak. Ges.*, xxxvii, p. 156 (Mukonje and Bibundi, Cameroon). Germain, 1911, *Bull. Mus. Hist. Nat. Paris*, xvii, p. 231 (Querké, Ivory Coast).

Bulimus pupulus Morelet, 1848, *Rev. Zool. Soc. Cuvier.*, xi, p. 352 (Gaboon). Pfeiffer, 1853, *Monogr. Helic. Viv.*, iii, p. 360.

Ennea (Edentulina) pupula Pfeiffer, 1859, *Monogr. Helic. Viv.*, iv, p. 336.

Liberia: Camp No. 3 on the Du or Dukwa River; Suehn; Kakatown to Gbanga; Zanschue to Suah Koko; Paiata; twenty-three specimens (J. Bequaert). Cape Palmas (M.C.Z.).

This species seems to be widely distributed in the West African forest region. In Liberia it is quite common. It differs from most species of the genus in the reduced size (19 to 25.3 mm. by 9.8 to 13 mm.) and the conical spire.

We agree with d'Ailly that *Bulimus liberianus* Deshayes, 1851, in Férussac, *Hist. Moll. Terr. Fluv.*, ii, pt. 2, p. 102 [date? Atlas, pl. cl, figs. 19-20; without name], could not possibly have been Lea's species. The measurements (22 mm. by 11 mm.) and figures seem to indicate *Pupa minor* Morelet (1851), from Madagascar, which has been sometimes placed erroneously in *Edentulina* and is probaby a *Gibbus*.

***Edentulina usambarensis*, new species.**

Fig. 13.

Description.—Shell conic, thin, rimately perforate, not appreciably flattened dorso-ventrally and possessing a strongly convex base. Colour of periostracum very light yellowish, the shell itself a pure white. Whorls 6, flattened, regularly increasing in width and forming a straight-sided and somewhat acute spire, produced at an angle of 69° from the base line; body whorl about two-thirds of the length of the shell. Summit obtusely rounded. Aperture higher than wide

and somewhat obliquely set to the axis. Outer lip white, narrow, and very slightly reflected, moderately ascending at the suture ; in profile the edge is straight and cast obliquely from the axis. Columella nearly straight, slightly thickened above, and folded over the umbilical rimation ; the umbilicus very narrowly open, slit-like. Sutures not impressed, not crenulated, but margined by an incised line along the inferior border. Sculpture : first two whorls smooth ; remainder finely and closely striated axially ; between the axial striæ there are microscopic ridges, set spirally, but difficult to see ; the sculpture is only slightly weaker on the ventral surface of the body whorl and is quite distinct behind the outer lip.

MEASUREMENTS.

Length	Greater Diameter	Lesser Diameter	Aperture	
17.2 mm.	8.8 mm.	8.0 mm.	6.5 by 4.5 mm.	Holotype

Holotype.—Museum of Comparative Zoology, No. 59919, Lutindi, Usambara Mountains, 4,000 feet, Tanganyika Territory (Arthur Loveridge, 1926).

Remarks.—*E. usambarensis* is one of the smallest members of the genus. It is characterized by the conical outline, its greatest diameter being in the lower third of the shell. It differs therefore in shape from the other East African species, but is similar to the West African *E. liberiana*.

APPARENT DISAPPEARANCE OF *LIMNÆA PEREGRA* FROM FRISTON POND, EASTBOURNE DOWNS.

By G. SHRUBSOLE.

(Read before the Society, 2nd November, 1935.)

THIS is an old disused farm pond of good size, with puddled bottom, situated 350 feet above sea-level. Round three sides of it there is a depression, and this shallow area, several yards in width, in wet weather is part of the pond. Owing to the droughts of the last three years weeds, coarse grass, and especially *Glyceria fluitans* have overgrown this area up to the deeper water, whilst it was merely wet mud. There is a good deal of *Juncus*, and the pond proper holds *Ranunculus aquatilis*, *Lemna minor*, and *Confervæ*.

L. peregra was taken in the pond in 1910 and at fairly frequent intervals since 1925, and the snail could always be seen when passing the pond. No other species was taken (excluding bivalves).

In 1926 *H. jenkinsi* was introduced into the pond, and on 15th April, 1930, was taken for the first time with *L. peregra*. The pond had not been dredged for a year or two, as its molluscan content was well known.

In 1929 or 1932 or possibly on both occasions *L. stagnalis* with *P. albus* got into the pond. It was first discovered on 5th April, 1934. Dredging amongst the *G. fluitans* brought up *L. peregra* and some young *L. stagnalis*. When the presence of the latter was realized a careful search produced some adult snails. *L. peregra* certainly predominated in numbers, the *L. stagnalis* were mostly one-third grown to quite small, but there was a number of adults.

During the next few months it appeared as if the *L. peregra* were decreasing in numbers, whilst the reverse was the case with *L. stagnalis*. As this might be due to the adult *L. peregra* dying off and the fry being inconspicuous, observation was continued and a few notes made.

5th July.—*L. stagnalis*, very plentiful; *L. peregra*, only a few seen.

28th August.—*L. stagnalis*, all over pond; *L. peregra*, not to be seen, but dredging produced a few fry.

11th October.—*L. stagnalis*, most plentiful; *L. peregra*, scarce.

1935. 1st March.—*L. stagnalis*, about 100; *L. peregra*, 1.

8th April.—*L. stagnalis*, in large numbers; *L. peregra*, 1.

6th May.—*L. stagnalis*, most numerous; *L. peregra*, 2.

28th May.—*L. stagnalis*, over 80 (counted); *L. peregra*, 1.

17th June.—*L. stagnalis*, plentiful; *L. peregra*, 1 dead shell.

12th July.—*L. stagnalis*, very plentiful; *L. peregra*, none found.

26th October.—*L. stagnalis*, most numerous; *L. peregra*, 3 (small).

Dredgings up to about June were mostly in the grassy area, but later, as the water fell, the pond itself was included. In dredging

care was taken not to pick conspicuous snails, but to use the dredge haphazard; but *L. stagnalis* could have been taken in almost unlimited numbers.

In the ponds on the Downs the adult *L. peregra* usually die off about June and only small snails are found later.

L. stagnalis in Friston Pond appears to be present in all stages (adult to fry) from March to November. It may live longer than *L. peregra*.

It is a question if *P. albus* (which got into the pond at the same time) is flourishing. Very few came to hand in this year's dredging, but it was not specially looked for.

H. jenkinsi is present in almost countless numbers.

Now, at the end of October, *L. stagnalis* can be seen everywhere in the pond (adult snails in this water become very dark coloured). Some pieces of paper floating on the water all have these snails on them. No *L. peregra* can be seen. A few years ago they were as numerous as *L. stagnalis* now is.

L. peregra has probably been in the pond ever since it was made (no date can be given), isolated, and with no fresh introduction of stock.

Can it be that the recently introduced *L. stagnalis* are more vigorous? At the same time there is no shortage of food in the pond.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

629th Meeting, joint with the Yorkshire Conchological Society, held at Leeds, 2nd November, 1935.

Miss Morehouse (President of the Yorkshire Society) in the chair.

Election of New Members.

L. C. D. Hermitte, D. C. Thomas, H. D. Russell, W. T. Trewin, S. W. Brooks, J. Bernström.

Papers Read.

"The Mollusca of the Pocklington Canal, near York," by H. Sowden.

"*Neritina fluviatilis* in Orkney," by A. E. Boycott.

"Colonization of Land Snails," by A. E. Boycott.

"The Habits of young *Helix pomatia*," by A. E. Boycott.

"Apparent Disappearance of *Limnæa pereger* from Friston Pond, Eastbourne Downs," by G. Shrubsole.

Mr. H. J. Armstrong gave an interesting talk on "Shell-Money" and exhibited many specimens from his collection.

Exhibits.

By Mr. J. C. North.—String of *Marginella* from Karachi.

By Mr. H. Sowden.—Specimens to illustrate his paper; also types of Cowries used as money.

By Mr. C. H. Moore.—Various species of British *Vitrea*, with critical notes on same.

By Mr. J. Digby Firth.—Copies of *The Conchologists' Companion*, by Mary Roberts, 1834; *Histoire des Coquilles*, by Brard, 1815; *Conchological Dictionary of British Isles*, by W. Turton, 1819; and *The Elements of Conchology*, by Thomas Brown, 1816.

By Miss Nora Fisher.—Varieties of *Littorina saxatilis* Ol. from numerous localities (on behalf of the Liverpool Museum).

By Mrs. Morehouse.—Series of Chitons from Tenby and Scarborough; also Australian species.

By Dr. J. W. Jackson.—*Paryphanta busbyi* (Gray) and *P. hochstetteri* (Pfeiffer) and their eggs; also "Ring Cowry", *Cypræa annulus* L., used as shell-money at Darjeeling, India, and Ibadan, Nigeria, W. Africa; *C. moneta*, rubbed down on back, from Belgian Congo, where it is known as "Jiggi"; and other forms of shell-money.

630th Meeting, held at the Manchester Museum, 7th December, 1935.

Mr. G. C. Spence in the chair.

Member Deceased.

C. H. Schill.

Papers Read.

"A Discussion of Dr. Engel's paper on 'The English Species of the Family Pleurobranchidæ'," by A. P. Gardiner.

"On a new *Aglaja* from Japan," by S. Hirase.

Exhibits.

By Miss Nora Fisher.—Many shell-necklaces from New Guinea (on behalf of the Liverpool Museum).

By Mr. C. H. Moore.—A series of *Papuina*; also *Anodonta cygnea* from Ashton.

By Mr. A. K. Lawson.—Ornaments made from shells.

By Mr. G. C. Spence.—Many species of *Pterocyclos*, *Rhiostoma* and others.

By Dr. J. W. Jackson.—Illustrations showing the uses of shells by natives of New Guinea.

631st Meeting, held at the Manchester Museum, 4th January, 1936.

Mr. G. C. Spence in the chair.

Candidate proposed for Membership.

Mrs. Cicely Mellor, Rochester, N.J. (introduced by W. H. Weeks and Mrs. Morehouse).

Members Deceased.

H. Coates. Rev. R. W. Nevill.

Exhibits.

By Miss Nora Fisher.—Series of shells from the Wexford gravels (Pleistocene), Blackwater Cliffs, near Enniscorthy; also large *Neptunea contraria* (L.) from the Red Crag (exhibited on behalf of the Liverpool Museum).

By Mr. R. MacDonald: Fragments of calcrete-pebble from hollow in sand-dune at Port Stewart, Northern Ireland. The included shells are *Cardium* sp., *Mytilus edulis* L., and *Hydrobia ulvae* Pennant—the last does not now live in the neighbourhood of the dunes.

By Mr. C. H. Moore.—Series of *Limnæa* spp. from American localities.

By Mr. G. C. Spence.—Various species of *Urocoptis* and *Schistoloma*.

ACCOUNTS FOR THE YEAR ENDED 31st DECEMBER, 1935.
Income and Expenditure Account.

INCOME.			EXPENDITURE.		
	£	s. d.	£	s. d.	£
To Annual Subscriptions:—					
For 1935—124 at 10s. .	62	0 0	By publishing and distributing <i>Journal of Conchology</i> :—		
2 at 7s. 6d. .		15 0	Vol. XX, Pt. 3 .	23 0 4	
15 at 5s. .	3	15 0	4 .	31 19 9	
			5 .	20 19 0	
			6 .	21 1 8	
Arrears	66	10 0			97 0 9
	5	0 0			
			Authors' Reprints .	11 1 1	
" Sale of Publications	71	10 0	Estimated cost .	5 0 0	
" Advertisements	26	6 1			
" Transfer from Life Membership Fund .	18	6 0			
	16	0 0	Less paid by Authors	16 1 1	
				3 3	15 17 10
					112 18 7
			Less Grant from Research Fund .	10 4 3	
			Provision in Account for 1934 .	30 0 0	
					40 4 3
			Printing and Stationery .		72 14 4
			Fire Insurance .		4 11 0
			Warehousing Stock .		10 0 0
			Expenses of Annual Meeting .		1 10 0
			Subscriptions—		8 19 9
			Malacological Society .	1 1 0	
			Zoological Record .	5 0	
			Lancs. and Cheshire Fauna Committee .	5 0	
					1 11 0
			Officers' Expenses .		5 2 7
			Balance, being excess of Income over Expenditure .		19 15 11
					£114 14 7

Life Membership Fund.

To Amount of Fund, 1st January, 1935	£		s.	d.
" Composition Fee	·	336	6	0
" Dividends and Interest	·	6	6	0
	·	16	0	0
	£358		12	0
By Transfer to Income and Expenditure Account		16	0	0
" Amount of Fund, 31st December, 1935		342	12	0
	£358		12	0

Research Fund.

[illegible]

BALANCE SHEET.

LIABILITIES.		ASSETS.	
Annual Subscriptions paid in advance	3 12 0	Investments.	
Provision for Glass-topped boxes	4 14 0	4% Funding Loan, £365 8s. 7d., cost	300 0 0
Provision for Authors' Reprints	5 0 0	4½% Conversion Loan, £202 13s. 3d., cost	200 0 0
Life Membership Fund	342 12 0	3½% Conversion Loan, £40 11s. 8d., cost	40 0 0
Research Fund	233 19 5		
Balance of Income and Expenditure Account—			
As on 1st January, 1935	11 10 2	Cash at Bankers and in hand	540 0 0
For 1935	19 15 11		81 3 6
	31 6 1		
	£621 3 6		£621 3 6

NOTE.—Assets in addition to those set out in the Balance Sheet are (a) Library, (b) Cabinets and Collections, (c) Stock of unsold Publications, (d) Annual Subscriptions in Arrear.

CHAS. OLDHAM,
Hon. Treasurer.

Audited and found correct.

C. H. MOORE.

A. K. LAWSON.

8th January, 1936.

SOME INTERESTING MONSTROSITIES IN CYPRÆIDÆ.

By F. A. SCHILDER, D.Ph.

[PLATE 9.]

A FEW years ago I published a review and classification of monstrosities occurring in Cypræidæ.¹ Later on I received four abnormal shells, which seem worth recording; they are represented on plate 9.

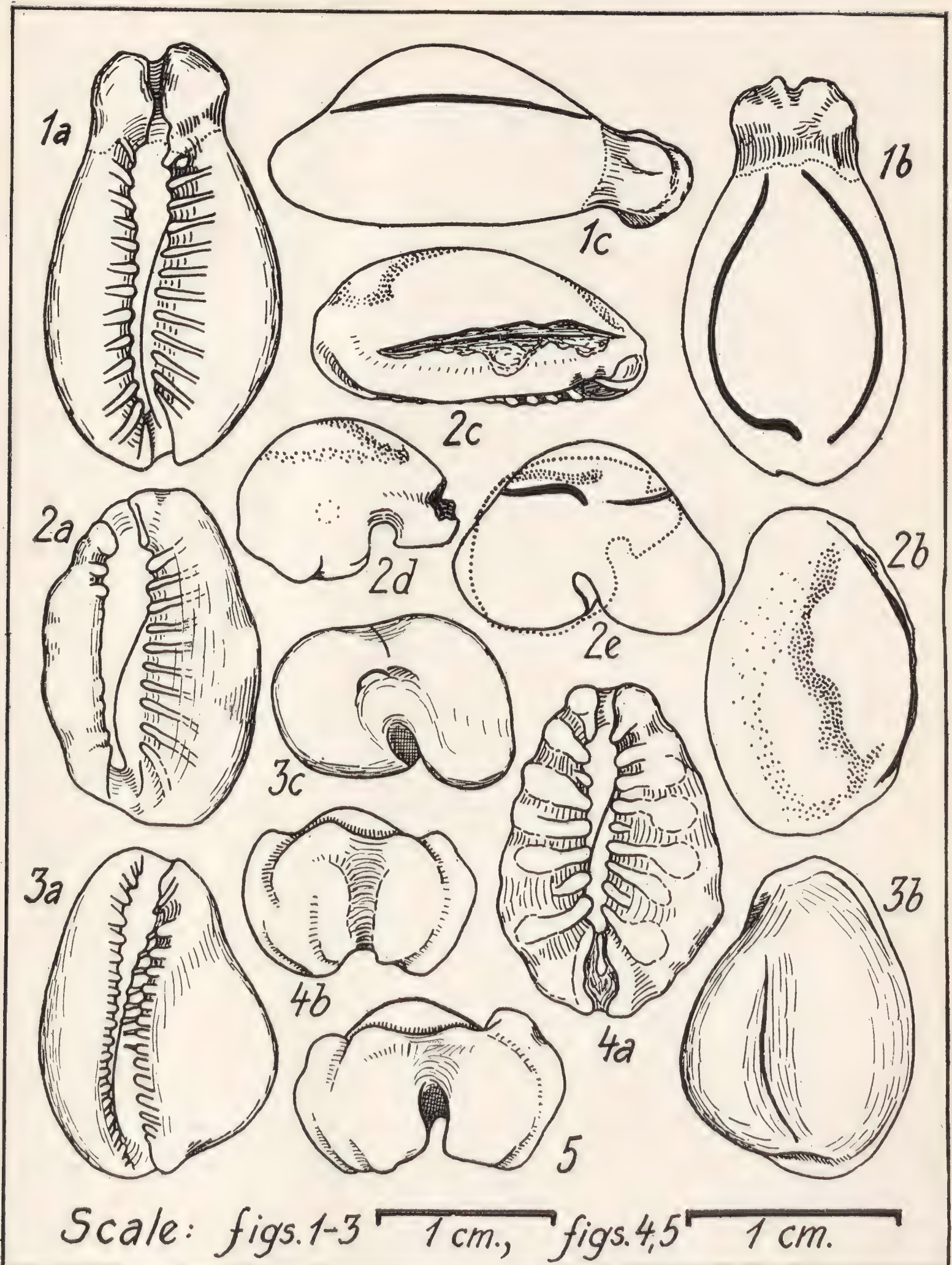
Fig. 1. An oblong *Monetaria annulus* Linn., from unknown locality,² seems to be quite normal with regard to the posterior extremity, to the flattened but not concave base (Fig. 1a: basal view), and to the narrow yellow ring by no means confused nor double (Fig. 1b: dorsal view). The only abnormality consists in a greyish fulvous, partially slightly iridescent callous thickening on the anterior extremity (its limits are marked by a dotted line), which encloses innumerable minute particles of mud; this thickening projects in the axis of the shell, so that the siphonal canal is by no means recurved (Fig. 1c: view from the right side). Therefore, this abnormality must not be confounded with the more frequent really rostrate "varieties". In the rim behind the anterior terminal ridge of the inner lip there is a grain of sand apparently situated outside the thickened callus, but covered by a thin layer of the same pathological enamel.

Fig. 2. A *Monetaria camelorum* Rochebr.,³ from Tanga, exhibits a quite stunted outer lip (Fig. 2a: basal view) and a deep longitudinal incision on the right side (Fig. 2c); the outer lip is narrow, short, and exhibits only a few traces of labial teeth; it is, moreover, elevated above the level of the inner lip (Fig. 2d: view from behind); the lateral incision is sharply cut, steep, and nearly straight on its dorsal border, whereas its basal border is less regular and partially incrustated by calcareous masses containing many particles of mud. The dorsal view (Fig. 2b) shows a pale-bluish area on its right portion, encircled by a deep yellow, rather broad, and somewhat confused ring, whereas traces of a much paler ring can be observed in the pale flesh-colour left portion of the dorsal surface. This monstrosity may have been caused as follows: The former

¹ *Zeitschr. Morphol. u. Oekologie der Tiere*, ser. A, vol. 19, pp. 144-159, with 48 figs. (1930); the most important former papers have been quoted in *Fossilium Catalogus*, part 1-55, p. 72, sub "Missbildungen" (1932).

² In a special study on geographical races and ecological varieties in *Monetaria* the Linnæan "*annulus*" (including *obvelata*) will be separated into five races; the figured shell seems to belong to the ecotype "A" of the Pacific race, which must be called *nouméensis* Marie.

³ In the paper noticed in the preceding footnote the "*annulus*" from East Africa will be separated as a distinct species, called *camelorum*; the ecotype of the figured monstrosity was "A".



top of the dorsum, the position of which is still indicated by the bluish area and by the deep yellow ring encircling its left border, was cut by some accident, so that almost the whole right side was broken off. The animal tried to regenerate this part of the shell, but its powers were insufficient to reconstruct the whole sixth of the periphery of the body whorl; therefore the animal attached the new outer lip immediately to the incision near the top of the dorsum, and was obliged to use a new level for the basal surface of the shell (Fig. 2e: the dotted line indicates the circumference of the monstrous shell from posterior view as in Fig. 2d, projected to a normal shell on normal level, marked by a drawn line). This change of the level caused a torsion of the inner lip indicated by an impression in its centre, by the abnormally narrow and depressed new body whorl, and by the beginning of a new yellow ring, which is still pale, but distinctly encircling the new dorsal area. Besides, the new outer lip became short, the outlets shallow, broad, and not situated in the axis of the shell.

Fig. 3. In a rather worn subpellucid specimen of *Erronea vredenburgi* Schil.,⁴ from Tjilaut Eureun, South-West Java (set "E"⁵), the left side is swollen in a curious way, so that the shell looks asymmetrical (Fig. 3a: basal view); the inflated portion is separated from the normal right half of the shell by a rather distinct longitudinal suture on the dorsum (Fig. 3b), accompanied by an impression especially in the posterior part of the shell (Fig. 3c; view from behind). The dorsal wall of the inflated left part is about as thick as the right part, but the transversal bands become indistinct. This monstrosity may have been caused by the left portion of the dorsum being hurt and regenerated; but it may also be explained by abnormal hypertrophy of some organ of the animal, as a specimen of *Erosaria gangranosa* Dillw., from the same locality (set "C"), shows a similar, though far less marked, swelling on the left side without any trace of suture.

Fig. 4. A small tuberculated shell of *Monetaria moneta* Linn., from the Gilbert Islands,⁶ shows a grain of sand squeezed into the posterior outlet (Fig. 4a: basal view); it has been covered by a layer of callus, which entirely fills up the outlet (Fig. 4b: view from behind). Fig. 5 shows the normal aspect of the posterior outlet in a specimen from New Caledonia.

⁴ A normal specimen has been figured in *Zoolog. Anzeiger*, vol. 85, p. 137 (1929).

⁵ See *Proc. Malac. Soc.*, vol. 21, p. 200 (1934).

⁶ In the study mentioned in footnote 2 the Pacific race of *moneta* will be separated as subsp. *tuberculosa* Quoy and Gaim.; the figured shell belongs to the ecotype "E", which formerly generally has been named *ethnographica* Rochebr.

Colonization of Land Shells.—As I am shortly leaving the neighbourhood I had better put on record the establishment in the garden of what has for many years been 17, and is now 20, Loom Lane, Radlett, Herts, of colonies of (1) *Helix pomatia* brought from Ramsbury in Wilts in 1920 and in 1923 and in larger numbers from the railway embankment at Coldharbour, Harpenden, Herts, in 1926; and (2) *Clausilia biplicata* brought from the locality (now perhaps destroyed) at Chiswick by Barnes Bridge in 1925. Of the latter I could find nothing till 1930, when a single specimen appeared and since then there have always been a few about.—A. E. BOYCOTT. (Read before the Society, 2nd November, 1935.)

The Habits of Young *Helix pomatia*.—Several people have commented on the boldness with which adult *H. pomatia* will walk about in the open in broad daylight: they behave as if they had no enemy to be afraid of, and their size and the thickness of their shells would seem to be an adequate protection against thrushes or any similar inland bird. Correspondingly it is very rare (though not quite unknown) to find their remains on thrush stones. From observations on a colony which has lived for some years in our garden, I can entirely confirm these impressions; adults are often out on the lawn in the daytime in suitable weather, and I have but once seen one (and that a three-parts-grown specimen) broken up by a thrush, though these birds have been very active during the last three dry summers in finding and smashing the few *H. aspersa* and *H. hortensis* which live in the garden. Young *pomatia* of about 20 mm. diameter or less I never saw at all alive or dead until by chance I looked over the patch of nettles and horse-radish in which they live with a lantern and so found that they are, wisely enough, nocturnal like most other snails.—A. E. BOYCOTT. (Read before the Society, 2nd November, 1935.)

Monodonta lineata (da Costa) in North Wales.—This littoral gastropod mollusk has, in Great Britain, an essentially south-western distribution, and in Wales its range extends northwards only to Pwllheli, on the south coast of Caernarvonshire, whence it was first recorded by Da Costa (*Historia Naturalis Testaceorum Britanniae* or *The British Conchology*, 1778, p. 101). In August of this year (1935) Mrs. A. Anderson brought me a small collection of shells made at Clynnog, which is about 9 miles south-west of Caernarvon, on the northern coast of the county, and in it were three perfect though dead shells of *Monodonta lineata*. The shells were fresh-looking and bore every appearance of being recent. All the shells in the collection were gathered on the beach at Clynnog, and no other part of the coast was visited. This northward extension of its range in Wales suggests that perhaps Donovan's old record of this species from Anglesea (see Jeffreys, *Brit. Conch.*, vol. 3, p. 318, 1865) is correct after all, although Forbes (*Brit. Assoc. Rept.*, 1850, p. 255) stated that its range ceased in Cardigan Bay or a little higher up, and Tomlin (*Trans. Liverpool Biol. Soc.*, 6, p. 114, 1893) says that the Anglesea record "certainly requires confirmation". The Clynnog specimens have been presented to the Free Public Museums, Liverpool.—NORA FISHER.

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Vol. 20]

1ST JULY, 1936.

[No. 8

... THE ...

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CONTENTS.

	PAGE
Conchological Cabinets of the Last Century (Presidential Address)—J. D. DEAN	225
A New <i>Clausilia</i> from Asia Minor (with Figure)—H. E. J. BIGGS	253
Some Tristram Types—A. J. PEILE	254
<i>Conus gracilis</i> G. B. Sowerby, III—J. R. LE B. TOMLIN	254
<i>Archidoris britannica</i> (Johnston)—Miss N. FISHER	255
Early Occurrence of <i>C. nemoralis</i> —W. F. LLOYD JAMES	255
Proceedings : Feb. 8, March 14, 1936	256

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No. 8

CONCHOLOGICAL CABINETS OF THE LAST CENTURY

By J. DAVY DEAN, F.R.E.S.

(Presidential Address delivered at the Annual Meeting, 19th October, 1935.)

INTRODUCTION.

A TRAVELLER when exploring new country often finds it wise to look back along the route by which he came, in order to determine the way he should go. Accomplishments of the morrow are based on our position to-day and guided by the footmarks, or records, of our yesterdays.

The extreme powers once enjoyed by ecclesiastics meant the suppression of all science, let alone any advance. At the end of the fourth century if any man thought for himself and expressed his views it was thought safer to burn him than to allow his doctrines to spread (1). Even as late as the twelfth century Alexander Neckham, the first English writer on zoology, adhered to the then prevailing belief that venomous and poisonous creatures existed to torment and reprove man for sin and disobedience to his Creator.

Not until the seventeenth century was any real progress possible, when conchology as a science began its first advance. Sir Christopher Wren, the famous designer and architect of St. Paul's and several London churches of great beauty, was also a Doctor of Science, and this should not be forgotten. It was he who saw, in the newly-invented compound microscope, the vast new field for research thrown open to the naturalist. Wren himself took a pleasure in making detail drawings of various objects, drawn to a scale of magnification never previously attempted. Others followed his example, and there is at this date the first record of an enlarged drawing of a radula (2). Another great landmark of the period was the founding of the first Museum of Natural History at Oxford in 1662. John Tradescant, gardener to Charles I, had established a curious collection of miscellaneous objects at Lambeth, known as Tradescant's Ark, afterwards bequeathed to Elias Ashmole, founder of the Ashmolean Museum. Included we have recorded the first publicly exhibited collection of shells, for to these special attention had been paid. Prominent at this period also was Dr. Martin Lister, the "Father of British Conchology", whose *Historia Animalium Angliæ*, published in 1678, is so well known. Lister's

book is outstanding because it was much ahead of its time and included many distributional records for British mollusca. In the Catalogue to the Ashmolean Museum there is a footnote which states that "the principal donations in shells came from Dr. Lister, Dr. Plott, Miss Pugh, Mr. Pratt, Mrs. Buckland, and the late Keeper of the Museum, J. S. Duncan, Esq." (3).

Dr. Robert Plot (not Plott) was the first "custos" of the Ashmolean Museum, appointed in 1683. The twelve cartloads of Tradescant rarities had arrived from London in March, and it is recorded that Dr. Plot had some of the exhibits arranged and exhibited to the Duke of York by May. John Plott was a successful miniature painter of a later date (1732-1803). It is recorded that he executed a number of beautiful water-colour drawings for a projected work on "Land Snails", which unfortunately remained unfinished at his death (4). If these drawings still exist they should be of a high standard, for Plott had the essential artist-naturalist combination, and obviously a great gift in portraiture.

The eighteenth century was a period of great scientific progress. The collections made by Petiver, incorporated later with the vast stores accumulated by Sir Hans Sloane, passed to the nation and became the nucleus of the material now housed in the British Museum of Natural History, South Kensington. This was in 1753. Between 1735 and 1768 Linnaeus had written and published twelve editions of the *Systema Naturæ* and revolutionized all biological nomenclature. For a time his collection remained with a noted botanist of the period, Sir John Smith, ultimately passing to the Museum of the Linnean Society. As is well known, many specimens were added to the collection, making subsequent investigation extremely difficult.¹

Thomas Pennant (1726-1798) was the first writer on British Conchology to adopt the Linnean nomenclature. *British Zoology*, vol. iv, containing the mollusca, was published in 1777 and there is a later edition, published by his son in 1812. Pennant's collection remained at Downing Hall, Holywell, Flintshire, for over a century. In 1913 it was presented to the nation by the Earl of Denbigh, and passed into the hands of the British Museum, Natural History, when it was critically examined by Edgar Smith (6), and later by Iredale (7). Smith enumerated six valid types to which should be added *Patella depressa* Pennant, first reinstated by Tomlin in

¹ Turton has an interesting note on the name Linnaeus: "In Sweden the termination -us is an affix to plebeian names only. After his enrolment, therefore, among the ranks of the nobility, it was exchanged for Von Linné or a Linné, exchanging the diphthong. In strict propriety then it should be Linné for his name; Linnéan for what appertains to his name; and *Linnéa borealis* for his plant" (5). In the *Systema Naturæ* the title-page of the 10th ed. (1758) has Caroli Linnaei, but those of the later editions (1766-1791) have Caroli a Linné.

1923 (*J. of Conch.*, Vol. 17, p. 34). The small total of eighty-two species contained in the collection was carefully listed by Smith.

Pennant received the degree of D.C.L. from the University of Oxford in May, 1771. His literary industry was immense. Johnson said of him: "He is a whig, sir; a sad dog. But he's the best traveller I ever read; he observes more things than any one else does." He also declared that Pennant had "a greater variety of inquiry than almost any man" (4).

THE NINETEENTH CENTURY.

Throughout this period specimens from many collections, large and small, passed through the hands of the systematists to be identified or described. A considerable number of collections reached the British Museum (12), but there were others which passed from one collector to another, either by sale or gift, or were directly or indirectly presented to, or purchased by, some public museum in the provinces or abroad. "This famous nineteenth century," as Melvill has called it, saw the creation of a multitude of new genera, species, and synonyms.

It is not possible to deal with all these collections, but it is thought that the location of certain of those which are of historical interest, set out in list form, would prove to be of value in future research. While the responsibility for the safe keeping of a collection rests with a curator, it often happens that such a collection is received in a state of more or less disorder. Much valuable help has been rendered in the past by members of this Society and others in cases of this sort, and it is certain that such help has saved many existing type-specimens from oblivion.

In order to get a proper view of this period it is necessary to provide some historical framing. The closing years of the eighteenth century were deeply seared by the horrors of the French Revolution, and the wars that followed. While the commencement of the nineteenth century saw the Peace of Amiens, this period of peace was ended a year later by the demands of Napoleon Buonaparte, to be followed by the Battle of Trafalgar, the Peninsular War, the American War and, in 1815, by Waterloo. During these early years increase in wealth had been enormous, and England was mistress of the seas. In 1833 the East India Company was abolished and the trade of the East thrown open, including, a few years later, several ports belonging to China.

Here is a conchological picture, crude but colourful.

Sailors, at all times, have been quick to find that curios, including shells, can be bartered for produce or for coin. Hugh Cuming, when a boy of about thirteen, had his enthusiasm fired by the stories told by the sailors visiting Kingsbridge in 1804 and 1805.

Lovell Reeve, in 1827, then also about thirteen, recorded in his diary how a sailor walked into the shop where he was employed and opened out a blue calico handkerchief full of cowries. This was the starting-point of his collection and conchological pursuits. For such boys there were few facilities, even in Reeve's time, for it is recorded that in the early part of 1828 there was no scientific arrangement of the shells, even at the British Museum. They were not described or even labelled. Nevertheless, preparatory work must have been going on and, a little later, we learn that "a spirit of improvement had visited the British Museum". It is stated that "Room No. 8 contains the collection of recent shells in twenty-six cases, well arranged, and conveniently displayed for inspection. The names of Lamarck are on one side, and those of Linnaeus (which are here more generally known) on the other . . . he (*the author*) would suggest that the collection might be made more instructive, by placing the name of each genus at full length, at the head of each compartment, where the species occupy more than one, . . . because learners who are examining the shells are frequently prevented from reverting to the generic words, by the company crowding round the cases. . . ." (8).

During Gray's time at the British Museum (1824-1875) certain dealers seem to have made a practice of offering payment to systematists for new species described, such being of more value from a pecuniary point of view and offering a greater inducement to trade (9). If this were so, it is easy to understand how some of the more showy genera have suffered and why some of the names proposed have no scientific value.

In considering the various collections during the nineteenth century, an endeavour has been made to deal with them in chronological order. Owing, however, to absence of data in some cases this has not always been found possible. The registration and numbering of specimens had hardly been thought of, and detailed catalogues were rare.

MONTAGU COLLECTION. LONDON AND EXETER.

Colonel George Montagu (1751-1815) was of the sportsman-naturalist type and one of the earliest members of the Linnean Society. He was a keen ornithologist as well as conchologist, and his collections of birds and other animals were purchased by the British Museum (4). Turton describes the transaction thus: "His cabinet of the natural history of the British islands is now very properly placed in the British Museum" (10). Jeffreys refers to the types of Montagu's *Bulla haliotoidea* and *B. plumula* and states that they are in the British Museum (11). Montagu published his *Testacea Britannica* in 1803 and the

Supplementary Volume in 1808. Mr. J. R. le B. Tomlin has recently segregated about twenty-four type-specimens in the British Museum belonging to the above collection. He states further that this was undoubtedly Montagu's first series.

A second collection presented many years ago by Henry D'Orville is located at Exeter. Tomlin believes that it contains, or did contain at one time, several species which did not reach the British Museum. Mr. F. R. Rowley, late Curator of the Royal Albert Memorial Museum at Exeter, has kindly examined this collection and checked a list of the species first described by Montagu. When Mr. Rowley first took charge of the Exeter Museum the collection was in a rather neglected state. A good many specimens were displaced and only a few of the original labels kept. These were preserved and the collection remounted in glass-topped boxes. The following species are represented :—

MARINE SPECIES FIRST DESCRIBED BY MONTAGU WHICH ARE IN THE EXETER MUSEUM

Gastropoda.

Gibbula tumida M. (*Trochus*). Nine specimens.

Lacuna crassior M. (*Turbo*). Three specimens on original card mount.

Hydrobia ventrosa M. (*Turbo*). Three on card and original printed label "ventrosus".

Cingula (Hyalia) vitrea M. (*Turbo*). Five on card and printed label "vitreus".

Alvania zetlandica M. 1815 (*Turbo*). Three on card with written label "Zetlandica".

A. (Actonia) punctura M. (*Turbo*). Four specimens on card.

Barleeia unifasciata M. (*Turbo*). Four on card with printed label "Unifasciatus".

Tornus subcarinatus M. (*Helix*). Four on card with printed label "Subcarinata".

Cerithiopsis tubercularis M. (*Murex*). Two on card with written label "Mu. Tubercularis".

Chrysallida decussata M. (*Helix*). Two on card with printed label "Decussata".

C. (Partulida) spiralis M. (*Turbo*). Three on card with printed label "Spiralis".

Trophon muricatus M. (*Murex*). One on card with written label "Mur. muricatus".

Lora turricula M. (*Murex*). Six specimens including three on card with written label "Mur. Turricula".

L. rufa M. (*Murex*). One on card with printed label "Rufus Murex".

Mangelia attenuata M. (*Murex*). Two on card with printed label "Attenuatus Murex".

M. nebula M. (*Murex*). Four on card with written label "M. Nebula".

Philbertia gracilis M. (*Murex*). One on card with written label "M. Gracilis".

P. purpurea M. (*Murex*). Two on card with printed label "Purpureus Murex".

P. linearis M. (*Murex*). Four on card with written label "M. Linearis".

Pelecypoda.

Astarte (Goodallia) triangularis M. (*Macra*). Three complete and five valves.

Thyasira flexuosa M. (*Tellina*). Five complete and five valves.

Diplodonta rotundata M. (*Tellina*). Three valves.

Kellia suborbicularis M. (*Mya*). Eleven complete specimens.

Gafrarium (*Circe*) *minimum* M. (*Venus*). Four valves including two on original card.

Paphia pullastra M. (*Venus*). Six specimens; var. *perforans* M. Five.

Ervilia castanea M. (*Donax*). Two valves on original card.

Thracia (*Ixartia*) *distorta* M. (*Mya*). One complete and one valve.

Land Pulmonata.

Laciniaria biplicata M. (*Turbo*). Two specimens on card.

Marpeasa laminata M. (*Turbo*). Seven specimens.

Helicella caperata M. (*Helix*). Nine specimens.

Theba cantiana M. (*Helix*). Three specimens.

It is probable that many of the original labels were lost before the collection reached Exeter. Labels may be lost in very simple ways. When the Cuming Collection was being mounted it was carried drawer by drawer across an open court-yard, as required. This resulted in many labels being blown away and subsequently gummed to the wrong tablets (12).

The Montagu Cabinet at Exeter contains 220 species and varieties, which are accessible to anyone interested. There is a note in this *Journal* by Jeffreys, in 1878 (13), concerning certain species in the collection.

LYONS COLLECTION. TENBY.

W. Lyons, of Tenby, one of the older conchologists who corresponded with Montagu and Captain Brown, is variously described. He is "Dr. Lyons" in an old Tenby Guide (1866) and "George Lyons, Esq., of Tenby, Wales" to Brown (14). His autograph can be seen in a copy of Lister's "Synopsis" at Tenby Museum.

Turbo crenatus (Linné) and *Turbo perforatus* (Perry) were among the shells sent by Lyons to Montagu in 1813, as then new to Tenby, quoting Montagu's labels from Exeter. This gives the earliest date. Later, Brown refers to Lyons as the collector of two of his new species, *Chiton discrepans* and *Turritella minor*, and two others, supposed to be new, his *Rissoa crystallina* (= *Hyala vitrea* Mont.) and *Hiatella striata*, which is the *Lyonsia norwegica* (Gmelin).

The Lyons Collection of shells was presented to Tenby Museum on 1st April, 1878, by Miss Lyons, and is exhibited there, as originally mounted, in a series of table-cases. He will be best remembered by the genus *Lyonsia*, dedicated to him by Turton, and by the var. *lyonsii* of *Calliostoma zizyphinum* (L.).

DILLWYN COLLECTION. CARDIFF.

Lewis Weston Dillwyn (1778-1855) was born at Ipswich, and was the son of William Dillwyn, descendant of an old Breconshire family. Dillwyn was placed by his father at the head of the Cambrian Pottery in Swansea in 1802; thus while his first scientific publication *British Confervæ* is dated "Higham Lodge, Walthamstow", the second, *A Descriptive Catalogue of Recent Shells*, is from (The) Willows, (Swansea), 1st January, 1817. The time intervening

between these two publications was therefore much taken up by the study of conchology, as well as in the production of the famous "Swansea China". Dr. Gray has stated that Dillwyn's *Catalogue* was one of the best books of the time.

Dillwyn's cabinet of shells is presumably indicated in the preface which reads : "The author, in the course of an attempt to arrange a small Cabinet of Shells, had occasion to observe that, in Gmelin's *Systema Naturæ*, the same species frequently appears under two or three different names ; and on the other hand that, in many instances, two or three different species are confounded together under one specific character " (15).

Dillwyn had enjoyed the liberal use of the library of Sir Joseph Banks, which passed in 1827 to the British Museum. This library contains Solander's MS. descriptions, and in the Dillwyn cabinet there is an example of *Conus amadis* marked "fulgens", the *Conus fulgens* Solander MS. (Portland cabinet.) An interesting specimen of *Nucella crispata* (Lamarck) (22) marked "*crisp^m*", is identical with Lamarck's figure, except for the slightly longer spire. If proof is needed that this collection was actually before Dillwyn when writing his *Catalogue*, it would seem to be supplied by a specimen of *Cardium papyraceum* Brug. The inner side of one valve is marked "*papyram*." and in the other valve is written *C. nitidum*. Dillwyn says, "I have bought this shell of Mr. Humphreys, under the name of *C. nitidum*, by which I believe it is generally known." An example of *Trigonia margaritacea* Lamarck is of interest, as this was the only recent species known up to 1838.

There are four specimens which should be considered as lectotypes :—

VENUS TIARA Dillwyn : *Descript. Cat.*, 1817, p. 162.

This agrees in details of sculpture with the description but is larger than the dimensions given.

BULLIA COCHLIDIUM (Dillwyn): *Op. cit.*, p. 627.

Buccinum cochlidium, *Chemnitz*, xi, p. 275, t. 209, f. 2053/4.

Chemnitz thought this was a land shell. Reeve in *Conch. Icon.* copies an immature shell from the British Museum. Dillwyn's shell is 2 inches long by $1\frac{1}{4}$ inches broad and is the form described as *gradata* by Deshayes, but very close to the figures given by Chemnitz. Apparently a variable species.

MUREX SCOLOPAX Dillwyn : *Op. cit.*, p. 681.

A well-known species, first recognized as distinct by Dillwyn, and separated from *M. tribulus* L.

DISTORSIO MULUS (Dillwyn) : *Op. cit.*, p. 704.

Dillwyn's shell follows the description in being less nodulous than *D. anus*, tubercles more regular, and in having the beak more produced and only slightly ascending (= *cancellinus* Roissy).

On 21st July, 1827, 200 *Ianthinæ* were picked up by Dillwyn at Oxwich Bay on the Gower coast. That these included both *rotundata* F. & H. and *exigua* Lk. is proved by the specimens in the Dillwyn Collection at Cardiff. A series of *exigua* in the Phelps Collection, taken at Ilfracombe, may be contemporary. An entry in the register at the Bristol Museum, for 6th September, 1827, records several *Ianthinæ* as received from L. W. Dillwyn.

Dillwyn's collection remained at Penllergaer, Swansea, until 1928, when it was presented, with other specimens, to the National Museum of Wales by Sir C. Venables Llewelyn, Bart.

Dillwyn's Index to Lister's *Historia Conchyliorum* was published at the special desire of the University of Oxford. The preface to this is dated from Penllergaer, 12th January, 1823. There is also a short paper on *Cypræa* in the *Zoological Journal* for 1828, but from this date his interests seemed to lie in other directions. There is a very full account of his scientific and public life in the *Cambrian Journal* by "Soranus" (Thomas Williams, M.D., of Swansea) (16).

LOVELL COLLECTION. BRISTOL.

An extensive collection of shells, formed by Dr. Lovell and valued at £500, was received by the Bristol Museum from Mrs. Lovell, in 1824.

ROWLAND COLLECTION. BRISTOL.

A varied collection of shells was received by the Bristol Museum in 1826, made by W. W. Rowland, R.N., at Whale Fish Island, Prince Regent's Inlet, Port Bowen, etc., during his passage on board H.M.S. *Hecla*, in 1824 and 1825.

SWAINSON COLLECTION. MANCHESTER.

William Swainson (1789-1855), of Elm Grove, near Liverpool, is mentioned by Turton (1822) (17). He had received two specimens of a *Pholas* from Torbay from the Duchess of Portland. Turton considered these as most probably the species then known as *Pholas papyracea* (= *loscombiana*), alluded to by Solander in the Portland Catalogue. For a list of Solander's valid names see *Proc. Malac. Soc.*, vol. xii, p. 89.

The Swainson Collection was purchased by the Manchester Natural History Society between 1825-6 and formed the nucleus of the old Peter Street Museum material, later transferred to Owens College (1869). Specimens were merged into the general collection and cannot now be traced. Dr. J. W. Jackson has, however, discovered three figured specimens of *Conus generalis* Linné. Swainson, in the *Zoological Illustrations*, figured many shells from his own and his father's collection, as well as some from other

well-known cabinets of that period—C. Dubois, Banks, George Humphrey, British Museum, Mrs. Bolton (Windermere), Mrs. Mawe, and Broderip. He described many new species (18).

TURTON COLLECTION. WASHINGTON, U.S.A.

William Turton, M.B., B.A. (1762–1835), resided in Swansea for about fifteen years (1791–1807), then at Dublin, Teignmouth, Torquay, and in 1831 at Bideford—the date of publication of the *Manual*. Previous to this date his fine and historical collection passed to William Clark, of Bath, and from him to Jeffreys. Our loss of the Jeffreys Collection meant also the loss of the Clark and Turton collections, for Turton wrote in his *Manual*, “The whole of my collections in British Conchology are now in your possession : and in the ensuing catalogue, nothing has been introduced of which perfect specimens cannot be found in that collection.” This was addressed to Clark and dated, “Bideford, Devon, 1831 ” (19).

Jeffreys, writing in 1867, says of *Triton cutaceus* (Linné), “For my specimens I am indebted to the liberality of Dr. Lukis and Mr. Macculloch ; I likewise have one in the Turtonian collection.” On the same page is a note on “*Triton elegans* ” stated to have been found alive at Portmarnock in Dublin Bay—the *Hindsia angusticostata* Pease, and Jeffreys adds, “Portmarnock has been from the time of Turton a prolific source of such erroneous additions to the catalogue of British shells ” (20).

Forbes and Hanley, under the genus *Turtonia*, write, “His collections are fortunately preserved in the magnificent cabinet of our valued friend and correspondent, Mr. Gwyn Jeffreys. A close examination of them has shown that Turton was not always to be relied upon in his published statements, and that a severe and critical judgment must be applied to his labours in conchology ” (21).

PARREYSS COLLECTION. LONDON.

Numerous shells were purchased by the British Museum from Herr Parreyss, a dealer in Vienna, between the years 1841 and 1847.

DIEFFENBACH AND YATE COLLECTIONS. LONDON.

A considerable amount of material from New Zealand was received by the British Museum between 1835 and 1852 and, in addition to the Dieffenbach and Yate collections, included numerous specimens from Dr. Stanger, Dr. Sinclair, Lieut.-Col. Bolton, R.E., and Captain Stokes, R.N.

RANKIN COLLECTION. BRISTOL.

Chief Justice Rankin, of Sierra Leone, presented to the Bristol Museum, in 1836, sixty-one species of shells (of which there is a detailed list) from the neighbourhood of the Gambia. This

collection is spoken of by P. P. Carpenter as a valuable and very reliable one. He says in the *Reigen Catalogue*, on. p. 472, "the principal part is to be found in the general Museum of the Bristol Institution."

BRODERIP COLLECTION. LONDON.

William John Broderip (1789-1859) was one of the most enthusiastic collectors of his time and firmly believed in every conchologist possessing his own collection. Accurate knowledge, he said, was impossible without adequate material for study, which the then existing public collections could not supply. Lamarck's natural arrangement of the mollusca was the best, he argued, because of the fact that Lamarck was himself a collector and *knew* his shells, and emphasized the fact that his descriptions of rare or interesting species were nearly always followed by the two words "mon cabinet" (22).

Broderip was interested in native methods of collecting. "In the Mauritius," he says, writing in 1825, "it is the amusement of the place to watch over the trim apparatus of lines hung over some sand-bank to tempt the various species of *Oliva* which there abound, or to wait for the more rare approach of the Harp Shell, till the rich hues of its inhabitant (vermilion red) are seen glowing through the clear blue water, in the rays of the tropical rising sun" (23).

The Broderip Collection was purchased by the British Museum in 1837.

BABB COLLECTION. BRISTOL.

An important collection of shells was received by the Bristol Museum, in 1832 and 1837, collected by Hugh Babb, R.N. This included such species as *Concholepas peruviana*, *Voluta lapponica*, ten species of *Chiton* from the west coast of South America, *Pinna nigrina*, etc., in all about 100 species, many of them rare at that time and new to the above Institution.

Babb is mentioned by Reeve in *Conch. Icon.* under *Murex bicolor* Val. = *erythrostoma* Swains., for which he gives: "Hab. Gulf of California (found on mud banks at low water); Lieutenant Babb, R.N. (Mus. Steere)." Miss Steere's collection is at the British Museum.

GUILDING COLLECTION. LONDON.

The Rev. Lansdown Guilding, of St. Vincent, has papers in the *Zoological Journal* dealing with the mollusca of the Caribbean Islands. He described several new species amongst which are *Stenopus cruentatus*, *S. lividus*, and *Helicina occidentalis* from St. Vincent (1828) (24).

His method of preserving the more delicate marine shells may not be remembered to-day. Certain species, especially bivalves, if killed in boiling water, cannot be cleaned without the risk of breaking an almost transparent shell. Guilding's method was to put them in stale sea-water ; i.e. sea-water which had been purposely left in the sun for a few hours. This causes the shell-fish to " die quietly " (to use his own phrase), fully extended, and in perfect condition for examination or dissection.

The Guilding Collection was sold by auction at Stevens', the first sale in 1838 and the last in 1840. The British Museum acquired a large number of the specimens, including a certain number of types.

WALTON COLLECTION. MANCHESTER.

William Walton is mentioned by Lovell Reeve in the *Proc. Zool. Soc.*, 1842, pp. 49-50, where *Helix waltoni* is described (*Acavus waltoni* auctt.). *Emarginula conoidea*, another species described by Reeve, was stated to be from the Walton Collection, afterwards bequeathed to the Manchester Museum. *Cypræa ocellata* var. *calophthalma* Melvill (1888) was described from a specimen in this collection.

KRAUSS COLLECTION. LONDON.

A series of South African shells, unnamed, purchased by the British Museum from Dr. Ferdinand Krauss, in 1840.

CUTTING COLLECTION. BRISTOL.

Several donations of shells are recorded in the Reports, etc., of the Bristol Museum from Dr. J. H. Cutting, and there is one from Mrs. Cutting in 1836. These mostly comprise specimens from the West Indies ; Barbados, Porto Rico, St. Thomas, and Tortola. A fine specimen of *Pholadomya candida* Sowb., received in 1838, is stated to be the third recent specimen known of this genus. A specimen of *Hyria elongata* Swainson was received in 1840. The last donation, received in 1841, included a specimen of *Strombus gallus* Linné.

LINCOLNE COLLECTION. SALFORD.

Abraham Lincolne, of Highbury Place, Islington, amassed a large collection of shells, valued at £1,000, between 1819-1836. This was presented to the Salford Borough Royal Museum and Library, Peel Park, by the Misses Heaven, of Victoria Park, Manchester, and of Cheltenham, in 1880.

The following notes are taken from the original catalogue, kindly lent by H. J. M. Maltby, Curator, to whom thanks are due. This is dated 1836.

The list of shells is prefaced by details as to how and when the specimens came into the owner's possession. Lincolne was a man of some wealth and was prepared to pay for perfect specimens.

A list of dealers in shells of that period is also of interest. Purchases were made by Lincolne at various times from Mrs. Mawe, Sowerby, Stutchbury, Dantzicker, Tucker, Turner, Eling, Moses, Mrs. Moses, Samuels, Solomons, Antinous (?), and other dealers at watering places. In 1839 Lincolne purchased, at Stevens', duplicates from the Chas. Collier Collection and, in 1848, added some species from Australia. Previous to this he had attended all the more important sales.

The Catalogue totals roughly 1,300 species, 350 being bivalves and 950 univalves.

Chiton is represented by twenty-five species and includes *C. aculeatus* from the "Blossom discovery Ship".

Cardium, with forty species, includes *C. æolicum* from Caldwell's sale, one bought for 3 guineas, another for £2 17s. 6d. A specimen of *Spondylus americanus*, which was Dr. Goodall's, is marked at £1 12s. (1840).

Placuna is represented by *placenta* and *P. lincolnei* Gray. There is also a note showing that a specimen of the latter was received by the British Museum on 21st April, 1848, the writer thanking Lincolne for his "obliging present".

Conus is represented by 120 species and includes *C. zonatus*, purchased for 3 guineas; *C. imperialis*, from the Countess of Essex' sale, 1838, marked at £4 6s. (Tankerville sale, 1825, 5 guineas); *C. omaicus*, from the Sir Richard Broughs sale, 1843, marked down at 10 guineas though it cost the baronet £20.

A specimen of *Voluta fusiformis* from the Stainforth sale, 1842, went for £1 8s. but there is a note to say that formerly one went up to £15, and another to £28 7s. 6d.

Harpa imperialis also realized good prices. Lincolne bought one from the Boddington sale, 1838, for £3 7s. and another from the Broughs sale for £2 3s.

HINDS COLLECTION. LONDON.

Richard Brinsley Hinds was associated with Captain Sir Edward Belcher, who was in command of H.M.S. *Sulphur* during a voyage round the world. The Hinds Collection was received by the British Museum in 1842, and the Captain Belcher Collection in 1851.

C. B. ADAMS COLLECTIONS. LONDON, WARRINGTON, AND AMHERST.

Professor Charles Baker Adams presented to the British Museum, in 1845 and 1850, 387 shells from the Island of Jamaica, many being co-types of species described in *Contributions to Conchology*.

Two further collections were presented to the British Museum in 1865 by the Smithsonian Institution at Washington : (a) a Panama series and (b) a series from Cape St. Lucas, Acapulco, Neeah Bay, and Puget Sound.

Dr. P. P. Carpenter and the Smithsonian Institution presented to the Warrington Museum, between 1860 to 1864, a collection of shells, numbering several thousands, amongst which were two series from the C. B. Adams Cabinets, (a) Panama and (b) British West Indies.

Adams was Professor of Zoology, etc., at Amherst College, Massachusetts, and his type collection is at the Amherst College Museum.

ALDER COLLECTIONS. LONDON AND NEWCASTLE-ON-TYNE.

Joshua Alder (1792-1867) will always be remembered as the joint author, with Albany Hancock, of *The British Nudibranchiate Mollusca*. A collection of their Nudibranchs and the original drawings, many of them coloured, are at the Hancock Museum.

Alder was associated with others in conducting a series of dredging expeditions in the North Sea, which were partly financed by grants from the British Association. Mr. T. Russell Goddard says that while the Alder Collection of shells at Newcastle was mainly British, he also gave to the Museum, from time to time, quite a number of exotic species.

In 1858 over 800 specimens of British Mollusca were presented by Alder to the British Museum. More than 300 of these were Nudibranchs.

BEAN COLLECTION. SCARBOROUGH.

William Bean (1787-1866) was associated with William Smith, the father of English geology, and with John Williamson, the first curator of the Scarborough Museum. Bean was the owner of land which came to be known as Bean's Gardens, now part of the shopping centre of the town.

The Scarborough Philosophical and Archæological Society purchased six or seven of his cabinets of shells in 1926. Because of lack of space in an already crowded museum, the contents of four of these cabinets were merged into the others.

Bean possessed a great number of exotic shells as well as a very representative series of British examples. *Chiton hanleyi* and *Patella athletica* were among the species he described in 1844. He had a sinistral *Nucella lapillus*, picked up by his little granddaughter at Scarborough, and exhibited by W. Gyngell at the Jubilee Meeting of this Society in 1926.

Carpenter acknowledged Bean's assistance in his preparation of the Reigen Catalogue of Mazatlan mollusca, and mentioned a collection of shells made by him in Guadeloupe. Besides collecting abroad he also exchanged largely, and many of the specimens at the Scarborough Museum bear the printed label of the Smithsonian Institution at Washington, as having been named from their type specimens. Much of the above information has been kindly supplied by Charles A. Wilson, the present curator of Scarborough Museum.

FRYER COLLECTION. MIDDLESBROUGH.

Joseph Harrison Fryer (died 1856), of South Shields, disposed of his collection of shells to Sir J. W. Pease, Bart., of Hutton Hall. At the baronet's death this collection was bought, and is now in the Dorman Memorial Museum, Middlesbrough, Yorks. The collection is a general one but contains many specimens of land shells from the Philippines and from South America. It also contains a number of species of bivalves from the rivers of Africa and from North and South America.

Dr. Frank Elgee, the curator, says that the collection had suffered from neglect when received, and that the specimens were mounted on cards with pencilled names, and with localities.

Fryer was associated with Alder and Hancock on the sub-committee appointed to draw up the "Catalogue of the Mollusca of Northumberland and Durham" (1848).

FORBES COLLECTIONS. EDINBURGH AND LONDON.

The collections made by Professor Edward Forbes were bequeathed to the Royal Scottish Museum in 1856. There is no detailed list but British, Mediterranean, and exotic species are represented. Forbes described the mollusca obtained during the voyages of H.M.S. *Herald* and *Pandora* by Captain Kellett and Lieutenant Wood, and his types were presented by them to the British Museum in 1850. It is not stated whether there are co-types at Edinburgh.

Professor Forbes is especially mentioned by Dr. P. P. Carpenter in his "Catalogue of Mazatlan Mollusca" (p. iv), thus: "One whose promised aid would have been of invaluable service, and whose friendly encouragement mainly induced me to undertake the work, was, at its commencement, suddenly removed from the field of labours which was opening before him with such promise in the metropolitan university of Scotland." He died in 1854, at the early age of 39.

Dr. Carpenter dedicated *Tonicia forbesii* n.s. to him (op. cit., p. 193).

H. & A. ADAMS COLLECTIONS. LONDON AND CAMBRIDGE.

Henry, the elder of the two brothers, was born in 1813 ; Arthur, the younger, in 1820. The younger brother described, with Lovell Reeve, the mollusca of the " Samarang " in 1850, and his drawings, made from the life while on board, are used for the plates in *The Genera of Mollusca*, published by both brothers between 1853-8 (25).

Mr. H. C. Fulton, who mounted the more important specimens in the MacAndrew Collection at Cambridge, states that one section of that collection, comprising 15,000 specimens, contains a number of the types of H. Adams and of others.

A collection of 192 marine shells from Japan, purchased by the British Museum in 1874, contains a number of species described by Arthur Adams but which were not figured.

STAINFORTH COLLECTION.

This collection is mentioned in the *Journal of Conchology* (vol. ix, p. 347) as having been sold by auction about 1850. The location of many of the Stainforth types was known to Melvill thirty-five years ago, but no details were given.

HULSE COLLECTION. LIVERPOOL.

A collection of Mazatlan shells was given to Liverpool Museum in 1854 by George Hulse.

WRIGHT COLLECTION. LIVERPOOL.

A collection of Dalmatian shells given to Liverpool Museum, in 1854, by a Mr. Wright.

JARDINE COLLECTION. EDINBURGH.

Sir William Jardine, Bart., presented a collection of shells to the Royal Scottish Museum, in 1854, which comprised the following :—

- (a) Land shells from the Andes of Quito, Ecuador.
- (b) Land shells from Bahia, Bolivia.
- (c) Land shells from Port Natal (Durban).

The number of specimens given is not recorded.

MACANDREW COLLECTIONS. LONDON, EDINBURGH AND CAMBRIDGE.

Robert MacAndrew, of Liverpool, left his collection of British Mollusca to the University Museum of Zoology, Cambridge, in 1873.

Dr. A. H. Cooke has given us a detailed account of the collection in this *Journal* (26), but the following species deserve mention :—

Acanthochitona discrepans (Brown). This species is correctly identified, the specimens being from Milford Haven. MacAndrew's

labels are uniform, the species' name in back-hand and the locality in copy-book hand. Cooke altered the label to "*C. fascicularis* var. *gracilis* Jeffr.", which is a synonym.

Emarginula crassa anassa Dean. Two specimens from Caernarvonshire and two from Loch Fyne. Writing of these Cooke states, "The labels were evidently misplaced, and I have transposed them." The two largest shells, the largest 35 mm. by 26 mm., were originally marked Caernarvonshire but are now labelled Loch Fyne.

Gastrana fragilis (L.). A fine series labelled Pwllheli. Cooke writes, "A locality not given by Jeffreys, whose only Welsh locality is 'coast of Pembrokeshire, MacAndrew'. Is there a mistake here?" Largest specimen, 1-5 inches broad. In this connection it is of interest to note confirmation of the locality by Jackson (*Journ. of Conch.*, vol. xix, p. 187), and a record for Llanbedrog in 1931 by Spence (op. cit.).

Clausilia dubia Drap. The record for Dover by MacAndrew is of interest and, surely, if not the first, one of the earliest.

Succinea oblonga Drap. A fine series marked Swansea, a lost habitat to-day, but a locality which has undergone considerable changes in recent years. Spence Bate has a MS. record, "Crumlyn," in a copy of Dillwyn at the National Museum of Wales, which may provide a clue.

In 1855, MacAndrew presented two collections from his European dredgings, one to the British Museum (Canary Islands, Spain, Portugal, Mogador), and another to the Royal Scottish Museum, Edinburgh (Mediterranean and Lusitanian species, marine and fresh water). A third collection, presented in 1873, is at the University Museum of Zoology, Cambridge (Mediterranean, Gulf of Suez, and Atlantic Islands).

See also the H. Adams and Benson Collections, formerly belonging to MacAndrew and now at Cambridge.

BENSON COLLECTION. CAMBRIDGE.

Merged into the MacAndrew Collection is a series of 15,000 specimens, including a collection from W. H. Benson, the well-known Indian conchologist, and embracing a number of type specimens from the cabinets of H. Adams and others. This information is kindly supplied by Mr. H. C. Fulton.

CHITTY COLLECTION. LONDON AND EDINBURGH.

The Hon. Edward Chitty presented to the British Museum a large collection of land and freshwater shells from Jamaica, in 1854, and a second collection was purchased in 1857.

A collection of about 400 specimens of land and freshwater shells from Jamaica, collected by Chitty, was received by the Royal Scottish Museum, Edinburgh, in 1855.

Chitty described nearly the whole of the minute species belonging to the genus *Stoastoma*, as well as a number of the larger Jamaican Operculates, but like C. B. Adams, did not figure his species.

CARPENTER COLLECTIONS. LONDON AND WARRINGTON.

Dr. Philip Pearsall Carpenter (1819-1877) presented to the British Museum in 1857, the collection of Mazatlan mollusca formed by Mr. Frederick Reigen between 1848-1850. His Catalogue of this Collection, published by the British Museum authorities (Warrington, 1855-7), is well known. The total number of specimens was 8,800, representing 692 species, of which 215 were described as new.

Dr. Carpenter, who occupied an official post at the Warrington Museum between 1860 and 1865, was instrumental in presenting to that institution several cabinets of shells, now merged in the general collection, illustrating the classification of the Mollusca. Through the Smithsonian Institution he secured from Dr. E. Ravener a U.S.A. Collection (1860), from the Rev. Professor Hincks and University of Toronto a Canadian Collection (1860), from Dr. Hubbard of Staten Island an American Collection (1864), as well as the C. B. Adams Collection previously mentioned.

W. WILLIAMS COLLECTION. LIVERPOOL.

W. Williams presented to the Liverpool Museum, in 1857, a collection of shells from the Bahamas.

M'KELLAR COLLECTION. EDINBURGH.

Dr. Fred M'Kellar presented to the Royal Scottish Museum, in 1857, a general collection of shells from many parts of the world.

ARCHER COLLECTIONS. LONDON, LIVERPOOL AND BIRMINGHAM.

There were two brothers of this name. Sam was an army doctor, and collected very largely abroad, sending shells to his brother Frank, a solicitor, and to the Liverpool Museum. Tomlin, by whom this note is kindly supplied, knew both Sam and Frank very well, spending a good deal of time with them. Sam retired as Deputy Surgeon-General (a rank now extinct) and travelled a great deal afterwards. It was on these travels that he came across the big *Pleurotomaria adansoniana* Crosse & Fischer, from Tobago, now in the Liverpool Museum. This was found on a shelf in a curio shop at Barbados. Some years afterwards he was out there

again and thought he would go to Barbados and have another look at that shop. To his amazement there was a second specimen ! This was purchased by the British Museum (Nat. Hist.), for £55. Sam Archer's Singapore collection was left in his will to Tomlin. The joint general collection of the two brothers was bequeathed to the Birmingham University.

CHARLESWORTH COLLECTION. LIVERPOOL.

A large collection of British Mollusca, collected by E. Charlesworth, was purchased by the Liverpool Museum, in 1858.

EYTON COLLECTION. LIVERPOOL.

Thomas Campbell Eyton (1809-1880) presented a collection of British Marine Mollusca to the Liverpool Museum, in 1858. He was the author of a series of papers entitled " An attempt to ascertain the Fauna of Shropshire and North Wales " (*Mag. of Zool. and Bot.*, 2, 1838 ; continued in *Ann. of Nat. Hist.*, 1-4, 1838-1840).

THE GASKOIN COLLECTION.

Dr. J. S. Gaskoin (1790-1858) was Surgeon-in-Ordinary to George IV. At his death his cabinets passed to Thomas Lombe Taylor, and at Lombe Taylor's death Melvill acquired a great many of the Gaskoin types. These are now incorporated in the Tomlin Collection at St. Leonards-on-Sea.

Trivia costispunctata Gaskoin is still a rare species.

MOTLEY COLLECTION. SWANSEA.

James Motley is mentioned by L. W. Dillwyn, in 1848 (27), and by his son, L. Llewellyn Dillwyn, in 1851 (28). Motley was engaged for some years in Labuan, an island off the west coast of North Borneo, and while there made various collections, including a series of 120 species of mollusca, now at the Royal Institution of South Wales, Swansea. He was massacred by Labuan natives in May, 1859.

STUTCHBURY COLLECTION. BRISTOL.

Samuel Stutchbury, soon after his return from the Pearl Fisheries in the Pacific, was appointed Curator of the Bristol Institution, now the City and County Museum. His earliest donation, several shells from the South Seas, was in 1827. A preparation of the shell and animal of *Trigonia lamarckii* Gray is interesting because of its early date—4th April, 1833. Other donations include a specimen of a madrepora, *Pavonia boletiformis*, enclosing an *Ostrea*, from

Tahiti; a specimen of *Cypræa scottii* from Swan River, a large *Pinna* from the North Pacific, *Cypræa aurantium*, and many species from Australia and the Pacific, in 1859.

Stutchbury was the first collector to take a living *Trigonia* which he placed on the thwart of the small boat, from which the animal leaped back into the sea. It was three months before he obtained another. This species was described by Gray in 1838 (29).

E. L. LAYARD COLLECTION. MANCHESTER.

Edgar Leopold Layard (1824–1900) had wonderful opportunities for collecting and was interested, not only in land and freshwater shells, but in other branches of natural history. His collection of non-marine shells, purchased by the Manchester Museum, was estimated at over 8,000 species. Collier states that he never bought a single shell during the whole of his lifetime (30). He founded the present South African Museum at Cape Town, and was Curator there until 1870. He collected in Ceylon, New Zealand, Fiji, and New Caledonia. His friends named a number of species after him, as he did not as a rule describe his own discoveries, but sent the specimens home.

FREDERICK LAYARD COLLECTION. BRISTOL.

General Frederick Layard, of the Indian Army, was a brother of Edgar Leopold Layard. It is of interest to note that he presented to the Bristol Museum, in 1862, a small collection of shells, one of which, *Streptaxis layardianus* Benson, was named after his brother.

TRAILL COLLECTIONS. EDINBURGH AND ST. ANDREWS.

Dr. William Traill (1818–1886) was in his younger days a medical student at the University of Edinburgh, where he graduated in 1841. His first appointment as surgeon took him, in 1842, to Madras, then to Hong-Kong, Singapore, and to Malacca, where he visited Mt. Ophir. From Singapore he sent home his first collection of shells, the precursor of several others. When home on furlough in 1854 he became acquainted with Dr. Knapp, a retired surgeon, and famous malacologist of that period. In this year a collection was received from Traill by the Royal Scottish Museum, Edinburgh, comprising 500 species of marine shells from these eastern seas. A large miscellaneous collection, received by the University, St. Andrews, Fife, is probably contemporary. In 1861 he retired and settled in St. Andrews.

Traill's collection was celebrated for his specimens of *Rostellaria rectirostris* Lamk. (= *fusus* L.), *Astrarium guildfordiæ* Reeve

= *triumphans* Phil.) and *Turbo imperialis* Gmel. For several years he took entire charge of the exotic mollusca at the Museum at St. Andrews and presented numerous specimens. These shells were arranged in the centre of the large hall.

Dr. Traill's private collection remained in store, after his death in 1886, for a number of years, but his trustees forgot to pay any storage rent. The local auctioneer, who owned the store, made the usual claim but offered to overlook this, on condition that the cabinet was presented to the St. Andrews Museum. This was agreed to, but by this time the contents were in complete disorder. It is a pleasure to be able to record that this state of things is no longer the case, thanks to the initiative of Professor D'Arcy Thompson, the present Curator.

RIPPON COLLECTION. CARDIFF.

Robert Henry Fernando Rippon (1836-1917), of Norwood, left to his widow a large collection of insects and shells, approximately 250,000 specimens. This was acquired in 1918 by the National Museum of Wales, through the generosity of the late Lord Rhondda. The mollusca number about 25,000 specimens and are very comprehensive in scope. There are numerous labels showing that many of the rarer species were purchased through dealers, the name of Bryce Wright being much in evidence. One such label reads, "*Voluta fusiformis*, Tasmania—£2 10s." Rippon does not seem to have published papers on the mollusca, his principal interest being centred in the Lepidoptera, more especially in the genus *Ornithoptera*.

He was believed to have had several reversed *Theba cantiana* and it was from one of these specimens that J. W. Taylor described the reversed variety. In 1918 these shells were critically examined, and found to be the sinistral *Eulota fortunei* Pfr. (31). There is a rough MS. catalogue of certain portions of the Rippon Collection, dated 1862.

FEDDEN COLLECTION. CARDIFF.

Francis Fedden was engaged on geological survey work for India in the early sixties, and made an interesting collection of shells from India and British Burmah. This was presented by his widow to the Public Museum and Art Gallery, Cardiff, in 1894.

The collection comprises about 300 species, marine and non-marine, principally from the Shan States and Burmah. Several of the latter were new and were mostly described by Blanford and Theobald in 1865 (32). Some of the new species are contained in the collection and are as follows:—

Blanford, 1865 : *Macrochlamys hypoleuca*, *Sitala confinis*, *Hemiplecta undosa*, *Plectopylis karenorum*, *Streptaxis burmanica*, *Pterocyclos feddeni*, *Diplommatina nana*, *Alycæus ingrami*, and *Helicina arakanensis*.

Theobald, 1865 : *Paludina naticoides*, *Pterocyclos insignis*, *Alycæus feddenianus*, and *Unio feddeni*.

Hanley, 1868 : *Clausilia tuba* (33).

The collection is now merged in the general Index series of Mollusca in the National Museum of Wales.

DENNISON COLLECTION.

John Dennison, of Woolton Hill, Liverpool, is described by Reeve in his diary as a country amateur of humble origin, but who having succeeded to the possession of a large fortune spent it most lavishly in the purchase of costly shells. His cabinet was of rose-wood, elaborately carved. The drawers were lined with velvet, in which the shells were placed "like a mess of porridge".

His collection was sold by Stevens, 21st–26th April, 1865, the sale being attended by many famous collectors, such as Cuming, Reeve, Angas, Lombe Taylor, H. and A. Adams.

CUMING COLLECTIONS. BRISTOL AND LONDON.

The Hugh Cuming Collection was purchased by the British Museum for £6,000 in 1866. It contained upwards of 19,000 species, represented by about 60,000 selected specimens.

Little needs to be added to the many published accounts of a collection which, with that of Broderip's, gave to the British Museum the important position it still maintains. There is a full account in Volume VIII of this *Journal*. Melvill has said that no public collection in Europe contained, at that time, one half the number of species possessed by Cuming ; also, that he was better known and respected on the Continent than in busy London.

A valuable collection of shells, presented by Cuming, was received by the Bristol Museum on four different dates. His first series, presented in 1833, included several new species from the South American Continent. A second series, received in April, 1843, consisted entirely of the new and wonderful land shells of the Philippine Islands (from which he had just returned) ; all named by him and in beautiful condition. A very much larger series was received in 1849, and comprised nearly 400 specimens, representing sixty genera and over 200 newly-described species, and others undescribed.

A fourth series was presented at the request of G. H. K. Thwaites,

of Ceylon, in 1856. This was representative of the non-marine molluscan fauna of Ceylon, as then known to Cuming. The above information is kindly supplied by Mr. H. Tetley, B.Sc., the present curator of the Zoological collections.

PHELPS COLLECTION. CARDIFF.

The Rev. C. M. Phelps (1841-1907) was resident in Tenby until 1888. His collection of British Mollusca was for some years in the possession of the late Dr. Y. H. Mills, of Haverfordwest, and was presented to the National Museum of Wales in 1916. Phelps seems to have been recognized as a conchologist in Tenby and was responsible for a local list published in the sixth edition of Mason's *Guide to Tenby* (1866). Yet Mills wrote to Dr. Hoyle saying he was certain the shells were not Phelps's own collecting. Specimens were mounted on cards with uniform printed labels, but with the locality written in the copy-book style of an earlier period and it is this writing that Dr. Mills noted as not that of Phelps.

The collection is a comprehensive and an interesting one. There are specimens of *Zonites glaber* from Manchester, and among the marine species, *Chiton discrepans* Brown from Tenby and *Ianthina exigua* from Ilfracombe. *Tellina proxima* Brown and *T. punicea* Gmelin are present, the former labelled Skye and the latter Weymouth. There is also a good specimen of *Donax denticulatus* Linné, labelled Guernsey; a species of which Pennant wrote, "Fine and perfect from Guernsea."

GREVILLE COLLECTION. EDINBURGH.

A large collection of exotic land and freshwater shells, together with a general collection of British Mollusca, in all about 5,000 specimens, was presented to the Royal Scottish Museum by Dr. Greville, in 1866.

ANGAS COLLECTION. LONDON AND NEWCASTLE.

George French Angas (1822-1886) presented a valuable collection of marine shells to the British Museum between the years 1870-1886. They included the types of 240 species described principally by himself. His collection of Australasian land shells, including many types, was subsequently bequeathed to the Hancock Museum at Newcastle-on-Tyne.

Melvill has an interesting note in this *Journal* with regard to two very beautiful specimens of *Harpa ventricosa* which were put up for auction at the sale of the first portion of the Angas Collection,

sold by Stevens on 11th May, 1869. These shells were *pure albinos*, and went to Lady Harriet Ramsden, Portman Square. They have never since been traced. Lady Ramsden's collection was dispersed in November, 1873 (40).

THEOBALD COLLECTION. BRISTOL.

A small collection from W. Theobald, the well-known Indian conchologist, was received by the Bristol Museum in 1868. These specimens are from the east coast of Bengal.

WORSLEY COLLECTION. BRISTOL.

A cabinet of shells, in which 250 species were represented, was received from S. Worsley by the Bristol Museum in 1871. Fossil species are included.

HIGGINS COLLECTION. LIVERPOOL.

The Rev. Henry H. Higgins (1814-1893) was contemporary with Marrat and associated with him during the "Argo" Expedition in 1876. The types of *Sconsia barbudensis* Higgins & Marrat, and *Murex (Chicoreus) imbricatus* Higgins & Marrat, are at the Liverpool Museum. He also presented to the Liverpool Museum, in 1860, a collection of North American shells, made by Edward J. Morse.

RASHLEIGH COLLECTION.

Jonathan Rashleigh, Junr., had a collection of *Cypræa*, which, according to Melvill, was extremely large and perfect. Little seems to be known of him except the fact that he lived at Menabilly, Cornwall, and died at the early age of 27 in December, 1872. Melvill records the fact that his collection was still in store in London in 1888 (39).

Cypræa rashleighana Melvill (1888) is described from a specimen believed at the time to be unique (34). A second specimen was found to be in the Cuming Collection (1866) which had been figured by Reeve as a stunted form of *tabescens*, but not detected until 1898 (35). But previous to this, in 1895, Melvill and Standen recorded a few further specimens among the Lifu material (Hadfield Collection), the first indication of a locality for this rare species.

JEFFREYS COLLECTIONS. LONDON AND WASHINGTON, U.S.A.

John Gwyn Jeffreys (1809-1885) made extensive collections of

marine shells, not only on the British coasts, but along the Mediterranean and Atlantic seaboard.

His British collection, with which were incorporated the Turton and Clark cabinets, was purchased for a very moderate sum by the Smithsonian Institution, Washington. The story of the transaction is a sad one for British conchologists. The collection was offered by Jeffreys to Dr. Günther—Director of the British Museum (Nat. Hist.) at that time—but was refused. Jeffreys immediately went to see Dall, then on a visit to this country, who asked for the refusal of the collection for 24 hours. This was agreed to. Dall thereupon cabled to Washington and obtained full authority to purchase. These facts are kindly supplied by Tomlin, who had them from the late J. T. Marshall.

Fortunately there is a certain amount of the Jeffreys material still available for reference in this country. His Mediterranean dredgings off Piedmont were purchased by the British Museum in 1856. Then there is the Melliss Collection from St. Helena, which was worked out by Jeffreys, and the St. John Collection from Japan, presented to the British Museum in 1873. There is also the magnificent collection of shells bequeathed by Jeffreys to the British Museum containing selected material from the *Lightning*, *Porcupine*, *Knight-Errant*, and *Shearwater* Expeditions, received in 1885 (12).

LOMBE TAYLOR COLLECTION. LONDON.

The Rev. Thomas Lombe Taylor, of Starston Hall, Norfolk, is mentioned by Reeve in his diary. In this he wrote enthusiastically, prophesying that the Lombe Taylor Collection would be one of the most complete in the whole of this country (1849). Thirty years later G. B. Sowerby described it as the largest private collection of shells in the world, and stated that it had cost £17,000. Among the collections purchased by Lombe Taylor was that of Gaskoin.

The Lombe Taylor Collection was dispersed between 1879 and 1880. An important series, including a number of Reeve's and Sowerby's types, was presented to the British Museum in 1875. A second series, acquired by the British Museum in 1879, was mainly composed of types.

SAUL COLLECTION. CAMBRIDGE.

Miss Jane Saul (died 1895), of Limehouse, specialized in *Cypræa*, of which genus she possessed one of the finest series ever gathered

together during the last century. Of her collection it will be sufficient to notice a few of the rarer species. Her specimen of *Cypræa barclayi* Reeve is unique. Other rare specimens are *Cypræa saulæ* Gaskoin, named after her in 1843; *Cypræa caput-colubri* Kenyon, *Cypræa princeps* Gray, *Cypræa broderipii* Gray; two specimens of *Cypræa guttata* Gray, and one of *Cypræa venusta* Sowerby (38).

Miss Saul's collection was bequeathed to the University Museum of Zoology, Cambridge. Reeve borrowed largely from it for the illustrations of *Cypræa*, *Conus*, etc., in the *Conchologia Iconica*.

BOLTON COLLECTION. WARRINGTON.

William Bolton, of Warrington, presented a collection of about 2,000 species and varieties of shells to the Municipal Museum in 1924. This was formed in the eighties and is world-wide in character. The specimens are mounted in boxes and merged in the general collection at Warrington.

CHOLMONDELEY COLLECTION. MANCHESTER.

Reginald Cholmondeley, of Condover Hall, Shropshire, would seem to have acquired some remarkably rare species and varieties of mollusca. His collection was presented about 1888 to the Owens College Museum, Manchester, by the late Earl Egerton of Tatton. *Conus cholmondeleyi* Melvill is unique (36). In 1888, Melvill described from this collection, *Cypræa fimbriata* var. *cholmondeleyi*; *C. ocellata* var. *palatha*, and *C. lamarckii* var. *redimita*. He also described, in 1889, the very beautiful *Zizyphinus haliarchus* (37).

DARBISHIRE COLLECTION. MANCHESTER.

Robert Dukinfield Darbishire (1826–1908) enjoyed a remarkably long period of conchological activity. In his copy of *British Mollusca*, by Forbes and Hanley, now in the National Museum of Wales, there are many marginal notes, some of which may be quoted. *Cochlodesma prætenue*, collected at Sandsfoot beach, Weymouth, September, 1851; *Chiton lævis*, dredged beautiful red individuals, 17 fms., between Guernsey and Herm, January, 1852; *Modiola phasiolina*, one fine, on an oyster shell in 14 fms., St. Bee's Head, July, 1853; *Cerithium adversum*, Gortein Bay, Roundstone, October, 1864.

In 1857, Carpenter acknowledged Darbishire's help in the preparation of his Reigen Catalogue, and in this work his name is associated with those of Gray, MacAndrew, Reeve, Clark, Bean, H. and A. Adams. Yet his literary activity continued till 1889.

His collections were presented to the Owens College Museum, Manchester. His Cephalopoda and a series of Tanganyika shells were presented in 1890; his Mediterranean collection in 1891; the exotic land and fresh-water mollusca (with the exception of the operculates, which went to Collier) between 1894 and 1897; the exotic marine mollusca (with the exception of *Scalaria*) in 1896. These dates are kindly given by Dr. J. Wilfrid Jackson.

NORMAN COLLECTION. LONDON.

The Rev. Canon Alfred Merle Norman (1831-1918) was principally interested in the marine zoology of the North Sea, describing many of his new discoveries in *The Annals and Magazine of Natural History*. His collections, known as the "Museum Normanianum", were presented to the British Museum between 1908-1910. The collection of marine mollusca is almost complete, and represents the species of our northern seas. It is exceedingly rich in all groups belonging to the Palæarctic Region.

Canon Norman did not agree with the great multiplication of names, due to Continental authors. In no class of animals has "hair-splitting" been carried out to so mischievous an extent. A great gain, he considered, would be achieved if able conchologists would, by close study, reduce the number of species to reasonable limits.

An account of the collection appeared in the *Journal of Conchology*, vol. vii, pp. 124-8, 1892.

All this labour and love of conchology has left us with a vast inheritance, and it is our duty in the twentieth century to take a share in the responsibility. There are still many mistakes to be rectified and much research is necessary. We live in an age of specialization. Sherborn has given us the *Index Animalium* and thereby cleared the ground immensely. Yet even to-day the name most frequently used for the Dodo is *Didus ineptus* L., although Sherborn has pointed out that it should be *D. cucullatus* (L.), Linné having named it twice (39). Attention may be drawn also to the spelling of the familiar molluscan names, *Mitra scabriuscula*—the *Voluta scabricula* Linné, and *Conus tessellatus*, originally spelt *tessulatus* by Born.

We puzzle over the differences or supposed differences between two such species as *Trivia monacha* and *T. arctica* till Dr. Marie Lebour, with her wonderful drawings, places the indisputably different veliger forms before us (*P. Zool. Soc.*, pls. 4-5, 1935).

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INDEX

	PAGE.		PAGE.
Adams, A.	239	Carpenter	241
Adams, C. B.	236	Charlesworth	242
Adams, H.	239	Chitty	240
Alder	237	Cholmondeley	249
Angas	246	Cuming	245
Archer, F. and S.	241	Cutting	235
Ashmole	225	Darbishire	249
Babb	234	Dennison	245
Bean	237	Dieffenbach	233
Benson	240	Dillwyn	230
Bolton	249	Eyton	242
Broderip	234	Fedden	244

	PAGE.		PAGE.
Forbes	238	Pennant	226
Fryer	238	Petiver	226
Gaskoin	242	Phelps	246
Greville	246	Rankin	233
Guilding	234	Rashleigh	247
Higgins	247	Rippon	244
Hinds	236	Rowland	232
Hulse	239	Saul	248
Jardine	239	Sloane	226
Jeffreys	247	Smith, Sir J.	226
Krauss	235	Stainforth	239
Layard, E. L.	243	Stutchbury	242
Layard, F.	243	Swainson	232
Lincolne	235	Taylor, Lombe	248
Linnaeus	226	Theobald	247
Lovell	232	Tradescant	225
Lyons	230	Traill	243
McAndrew	239	Turton	233
M'Kellar	241	Walton	235
Montagu	228	Williams, W.	241
Motley	242	Worsley	247
Norman	250	Wright	239
Parreyss	233	Yate	233

A NEW CLAUSILIA FROM ASIA MINOR.

By H. E. J. BIGGS.

(Read before the Society, 9th May, 1936.)

Armenica (Creniclavis) euprepes, sp. nov.

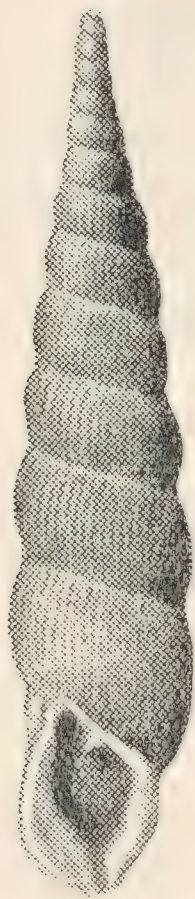
Shell sinistral, fusiform, purplish brown, semi-transparent, dull, imperforate, whorls $12\frac{1}{2}$; protoconch consisting of $2\frac{1}{2}$ smooth, horn-coloured whorls; costæ regular, parallel, fine and close, about 9 to the mm. on 11th whorl; strong crest behind peristome; aperture piriform; peristome continuous, free, somewhat reflected, deep sinus at upper angle; columella plait narrow, deep channel at base of aperture; interior pale brown.

Holotype.—Alt. 19.3 mm.; Max. Diam. 3.9 mm.

Average for 10 paratypes.—Alt. 20.0 mm.; Max. Diam. 4.1 mm.

Habitat.—Near Maçka, Trebizond Province, Asia Minor.

Holotype in my collection; paratypes in Brit. Mus.



These shells were collected by Mr. E. K. Balls in July, 1933. The proposed new species bears some resemblance to *Oligoptychia unicristata* Bttg., but besides generic distinctions differs by being more coarsely striated and somewhat thicker. *Armenica (Creniclavis) huet* Mort. is a close relative, but is horn-coloured, larger and more coarsely striated than this species, and the costæ are not so regular, a difference which is very noticeable, comparing the middle whorls.

The species also occurs at 1,100 feet above Maçka, a set of ten having been obtained by the same collector in June of the same year.

SOME TRISTRAM TYPES.

By A. J. PEILE.

(Read before the Society, 4th April, 1936.)

A SELECTION of shells from the collection made by Canon H. B. Tristram in Palestine, including some of the types, was recently presented to the National Collection by Dr. C. T. Trechmann. Tristram's report on the collection was published in *Proc. Zool. Soc.*, 1865, pp. 530 to 545.

The following notes on the synonymy of a few of the species are published by permission of the authorities of the Natural History Museum :—

(1) *Succinea globosa* (p. 531). Of two shells so labelled, one, which agrees with the published description, is a form of *Limnæa lagotis* (Schrank).¹ The other shell, measuring alt. 17, diam. 11 mm., appears to be a form of *S. putris* (Linn.).

On p. 540 "*Limnæus tener*, Parr." is recorded from the identical locality, viz. Lake Huleh, Merom.

(2) *Pupa libanotica*, p. 538. The holotype proves to be *Orcula orientalis* (Pfeiffer).² Two columellar plaits are present, not mentioned in the original description.

(3) *Pupa hebraica*, p. 539.³ The holotype is a form of *Orcula* (*Pilorcula*) *raymondi* (Bourguignat), differing only in having two columellar plaits instead of three. The specimen is somewhat worn and therefore devoid of spines.

Conus gracilis G. B. Sowerby III.—The above combination has been used at least three times for different species : (1) *C. gracilis* G. B. Sowerby II, in *Gen. Rec. and Foss. Shells*, pt. xvi, pl. 267, f. 4, 1823, was a synonym of *Conus australis* Lam., *fide* Sowerby himself. (2) *C. gracilis* Wood, *Ind. Test. Suppl.*, p. 8, pl. iii, f. 3, 1828, is said to be *C. timorensis* Brug. (3) *C. gracilis* G. B. Sowerby, III, *P.Z.S.*, 1875, p. 125, pl. xxiv, f. 6, is an extremely rare species which was once in the Prevost Collection and subsequently in that of Melvill. Tryon suggests that it is Reeve's *aculeiformis*, but I think this is erroneous, and as it is in need of a name I have great satisfaction in calling it *Conus hopwoodi*.—J. R. LE B. TOMLIN.

¹ *Fauna Boica*, iii, 1803, p. 289.

² *Malak. Blätt.*, viii, 1861, p. 168, Taf. 3, ff. 6–8.

³ *Mollusques Nouveaux, Litigieux ou Peu Connus*, 1863, p. 48, pl. 6, ff. 10–13.

Archidoris britannica (Johnston).—During August of last year I was fortunate enough to witness a most curious piece of behaviour on the part of large numbers of *Archidoris britannica* (Johnston). The locality was the north shore of Belfast Lough, at Greenisland, Co. Antrim, about 8–9 miles from Belfast, the date 6th August, and the time between 10 and 11 a.m. The following notes were made on the spot: “Below the house called Ballinascreen on marl-flat at low water (*Fucus serratus* zone) extraordinarily plentiful, and behaving in a manner quite unlike their usual style. Many (about 50 per cent) were lying helplessly upside-down, and some were already dead. Almost all were full-sized (about 70 mm. long), but a few were smaller, ranging down to 40 mm. In an area of shore about 70 feet square 84 specimens were noted, many lying dead or dying in the strong sunlight. Multitudes more were crawling actively about in a few inches of water. The marl-flats just at this point are covered with a thick growth of red and green algæ. Only a very few Archidorids were noted in their usual sort of habitat, flattened into a dark sheltered corner, and protected from the rays of the sun. All along the shore the species was noted in the most astonishing abundance, only paralleled in numbers by their abundance in March and April when spawning, but then they are found under stones and weeds, not crawling about in the sun or cast up helplessly on to the beach. Right along the shore from Seapark Dyke A. to the Gut (a distance of about 1 mile or a little more) they were plentiful in rock-pools, crawling on bare sand and rocks, and dead or dying specimens everywhere high and dry on the shore. The specimens which were crawling about on the marl-flats in about 3–8 inches of water were freely exposing themselves to the rays of the sun, and were mostly crawling towards (or at any rate in the general direction of) the shore.” The tide was not a spring (actual height at Belfast 10·8 ft., as compared with almost 12 feet at springs, and height at L.W. 2 feet as compared with between 2 and 6 inches at springs), nor had there been any gales or indeed any wind at all, so no obvious cause can be advanced to account for the extraordinary abundance of *Archidoris*, or for their unusual behaviour. I have never seen them moving about in the strong light of the sun on any other occasion.—NORA FISHER. (*Read before the Society, 8th February, 1936.*)

Early Occurrence of *C. nemoralis*.—On Sunday, 2nd February, I saw a *C. nemoralis* L. here, out and about, though a bitterly cold north wind was blowing and a quarter of an hour later the ground was white with hail.—W. F. LLOYD JAMES. (*Read before the Society, 14th March, 1936.*)

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND.

632nd Meeting, held at the Manchester Museum, 8th February, 1936.

Mr. G. C. Spence in the chair.

Election of New Member.

Mrs. Cecily C. Mellor.

Papers Read.

"Mollusca of the Sheep Ponds on the Eastbourne Downs," by G. Shrubsole.

"Curious Behaviour of *Archidoris britannica* (Johnston)," by Miss N. Fisher.

Exhibits.

By Miss Fisher : *Mytilus edulis* L. (normal) from Eglington, co. Derry ; ditto (eroded) from the Embankment, Eglington ; and ditto (dwarfs) from Leasowe, Cheshire.

By Mr. F. Taylor : *Xeroclivia elegans* (Gmelin) from Chaldon, Surrey, collected 21st October, 1935.

By Mrs. Morehouse : *Achatina fulica* Fér. from Calcutta ; also eggs, young and adults of the same species from Kuala Lumpur.

By Mr. C. H. Moore : Series of species of *Columbella*.

By Mr. G. C. Spence : *Helix aspersa* (Müll.) from Johannesburg, Transvaal.

There was a special exhibit of Lancashire and Cheshire Marine Mollusca.

633rd Meeting, held at the Manchester Museum, 14th March, 1936.

Mr. G. C. Spence in the chair.

Candidate Proposed for Membership.

Wilfrid Edward Reeve, 70 Underhill Road, East Dulwich, London, S.E. 22 (introduced by Hugh C. Fulton and J. W. Jackson).

Papers Read.

"Early Records of Lancashire and Cheshire Non-Marine Mollusca by James Wright Whitehead," by Miss Nora Fisher and Dr. J. Wilfrid Jackson.

"A Sea-shore Census for British Mollusca," by J. Davy Dean, F.R.E.S.

"Early Occurrence of *Cepæa nemoralis* (L.)," by W. F. Lloyd James.

"Enemies of the Land and Freshwater Mollusca of the British Isles," by S. V. Wild, M.Sc.Tech., A.I.C., and A. K. Lawson, F.R.Met.Soc.

Exhibits.

By Mr. A. K. Lawson : Various species of shells eaten by enemies.

By Miss Fisher : *Paphia pullastra* (Mont.) from Valencia Is., Kerry.

By Mrs. Morehouse : Various operculates from Sarawak (Chas. Hose collection).

By Mr. G. C. Spence : Species of *Achatina*.

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CONTENTS.

PAGE

Yorkshire Cephalopoda—W. J. CLARKE	257
A New <i>Aglaja</i> from Japan (plates 10 and 11)—S. HIRASE	258
Obituary Notice: H. Coates—JOHN RITCHIE	262
Studies of African L. & F.W. Moll.: Notes on <i>Gonaxis</i> Taylor with Description of a New Species (text-figures)— J. BEQUAERT and W. J. CLENCH	263
Mollusca Destroyed by Frost—J. R. LE B. TOMLIN	273
Early Records of Lancs. and Cheshire Non-Marine Mollusca by J. W. Whitehead—N. FISHER and DR. J. W. JACKSON	275
<i>Helix minuscula</i> Binney—A. J. PEILE	281
<i>Simnia patula</i> (Pennant) in Orkney—R. RENDALL	283
Editorial Notes	286
Proceedings: 4th April, 9th May, 1936	288
Plates 10 and 11.	

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YORKSHIRE CEPHALOPODA.

By W. J. CLARKE, F.Z.S.

IN the interesting article on "The Cephalopoda of the Yorkshire Coast", by J. A. Stevenson, published in the *Journal of Conchology*, April, 1935, the writer says: "There is some question as to the occurrence on the Yorkshire coast of the common octopus (*O. vulgaris* Lamarck). It is entered without comment in the record book of the Scarborough Field Naturalists Society, but since no mention of *Eledone* was made in this book we believe that the latter has been confused with *octopus*."

Mr. Stevenson's surmise has been proved to be quite correct.

The record in the S.F.N.S. book says simply: "*Octopus vulgaris*, J. C. H.," no date or particulars being given. I recently came across Mr. J. C. Harrison, who made the record, and he told me that the creature was identified and named by the late Dr. Harvey, of Scarborough. Fortunately Mr. Harrison still had the specimen in his possession, and I asked him to examine it and see whether it possessed a single or a double row of suckers on each tentacle.

Mr. Harrison has replied: "The octopod I have has one row of suckers on each tentacle—it is still in good condition."

It is evident, therefore, that the species is *Eledone* and not *O. vulgaris*.

A NEW AGLAJA FROM JAPAN.

By SHINTARO HIRASE.

(Read before the Society, 7th December, 1935.)

[PLATES 10 AND 11.]

THE opisthobranchiate fauna of the coast of the Biological Station of the Tokyo Imperial University at Misaki is particularly rich, and some of them have already been published by the late Sir C. Eliot. The specimen here noted was caught by a collector of the Biological Station on the 4th November, 1929. The preserved material in very good condition was kindly placed at my disposal by Mr. M. Iwasa, assistant of the Imperial University at Sapporo, and it was painted while alive in water colour by him.

I am glad of this opportunity of expressing my thanks to Mr. M. Iwasa for my pleasure in investigating the species.

AGLAJA IWASAI, sp. nov. Nom. Jap. Tunonasiohkurogahi.

General Colour.—Judging from the dorsal aspect of the living animal (Pl. 10) sketched by Mr. Iwasa, the animal seems to be warm blackish brown in colour, while living. Along the median line of the head shield are two fairly large amber yellow spots, anterior (Pl. 11, f. 1, AYS) and posterior (Pl. 11, f. 1, PYS). The anterior margin of the body and inner margin of the anterior end of the head shield have amber yellow dot lines respectively. The posterior margin of the head shield is rimmed with a narrow amber yellow line. Both the anterior ends of the parapodial lobes are also rimmed with amber yellow lines. The posterior margin of the mantle has few amber yellow parts. I cannot designate the true colour of the foot, but it seems to be the same as that of the dorsal body.

In the preserved specimen both parts are of dull purplish black colour, but the anterior margin and the antero-lateral margins of the foot are rimmed with black lines.

Body.—The body is ovate oblong and somewhat swelled in the middle portion.

Dimensions.—The measurements of the well-preserved specimen are 80 mm. long, 44 mm. wide, and 36 mm. high.

Head-shield.—The form of the head-shield (Pl. 11, f. 1, HS) is somewhat elongated oblong, and not bilobed behind. The posterior tip of the head-shield is somewhat projected like a tongue, and both the basal parts of this projection are more or less notched. The head-shield is free from the body on its posterior and lateral margins. The length of the head-shield is 40 mm., the breadth 33 mm. The distance between the two amber yellow spots is 14 mm.

The distance between the centre of the anterior spot and the anterior end of the head-shield is 19 mm. The anterior spot is almost round and its diameter is 3 mm. The posterior spot is more or less elongated and its size is 4×3 mm.

Parapodial Lobes.—The parapodial lobes (Pl. 11, f. 1, PL) are free and their margins are rimmed with sorghum brown colour lines. The anterior parts of the parapodial lobes have short amber yellow rims. The fleshy parapodial lobes are recurved on the dorsal sides of the body, but not so large as to be used as swimming organs.

Mantle.—The posterior end of the mantle (Pl. 11, f. 1, MT) has two somewhat large lobes and a large gaping orifice between the lobes.

Foot.—The foot (Pl. 11, f. 2, FS) is rather wide, its widest median part measuring 42 mm., and its length covering the length of the body. The anterior margin of the foot is not truncate, and is rather rounded. The sides of the foot are continued in fleshy parapodial lobes.

Branchia.—The white branchial plume is rather large (72 mm. long, along the outer side, 29 mm. wide, and 8 mm. thick), and is situated at the posterior end of the body on the right side (Pl. 11, f. 1, GL), its free extremity (Pl. 11, f. 2, GL) curving to the left side of the body. Both the dorsal and ventral sides of the branchia are subdivided into about 11–12 leaflets, each of them being folded to many small filamentous appearances (Pl. 11, f. 3).

Anus.—The oval anal papilla stands about 2 mm. just in the median line of the body near the left basal part of the branchia. The largest diameter of the anus (Pl. 11, f. 1, 3, AN) is about 3.5 mm. The inner wall of the anal papilla is folded.

Genital Pores and External Spermatic Groove.—The male reproductive opening (Pl. 11, f. 1, MP) is situated on the anterior right side of the body near the mouth. This opening is connected by means of a fine groove, the spermatic groove (Pl. 11, f. 1, SGR), with the common genital opening (Pl. 11, f. 1, CGP), which is found on the right posterior side of the body near the beginning of the branchia. The length of the spermatic groove is 45 mm. along the lateral side of the body.

Shell.—The shell (Pl. 11, f. 4) is internal and situated at the posterior extremity of the body, only covering a part of the gill. The calcareous part of the shell is lilac grey in colour. The volute part is very small, and the outer membranous expansion is rather broad. The length of the shell is 20 mm. and breadth 11 mm.

Central Nervous System.—The central nervous system, as usual in the genus, lies on the anterior dorsal surface of the large pharyngeal bulb and the three ganglia (cerebral, pedal, and pleural) are small but distinct. Besides these three ganglia there is a distinct

parietal ganglion under the right pleural ganglion. Each buccal ganglion is very small, but pretty distinct, and is connected with the other by means of a very fine, short, connective. The buccal ganglia (Pl. 11, f. 5, BG) are situated on the ventral face of the pharyngeal bulb, at a spot about two-thirds from the anterior end. Thus it may be seen that the buccal ganglia, as compared with the central ganglio-mass, are situated quite behind the pharyngeal bulb.

Alimentary System.—The ovate mouth opening has two black lip-like lobes. The vertical length of the mouth is 10 mm., and its breadth 6 mm. Mouth cavity is not high (about 3 mm.); it leads into the cavity of the voluminous pharyngeal bulb. The bulb is extraordinarily large, 37 mm. long, 25 mm. wide, and 24 mm. high, and has a pear-shaped form. Its outer surface is arranged with many fine parallel lustrous longitudinal fibres. The posterior end of this bulb (Pl. 11, f. 5, 6) is connected by the short stalk with the stomach, has no mandibles or radula, and its wall is very smooth except the closely arranged, very fine transverse fibrils. Along the median line the wall of this pharyngeal bulb in the pharyngeal cavity makes a large fold, the breadth of which is 10 mm., its height 13 mm., and a large groove on the ventral outer surface of the pharyngeal bulb.

Stomach.—The stomach (Pl. 11, f. 6) is a rather small muscular sac under the large liver. The colour of the stomach is pale chalcedony yellow with vinaceous lilac spots. There are no horny teeth or spines, but an ear-like folded process (Pl. 11, f. 6, FP) protrudes on the posterior part of the stomach. The inner wall of the stomach is strongly folded. The length of the stomach is 14 mm. and the width 13 mm.

Liver.—The compact, voluminous liver is posterior to the pharyngeal bulb and its colour is dark porcelain green in the preserved specimen. The length of the liver is 13 mm., its breadth 22 mm., and its thickness 16 mm.

Pericardium.—The pericardium and the heart are of the type common to this genus.

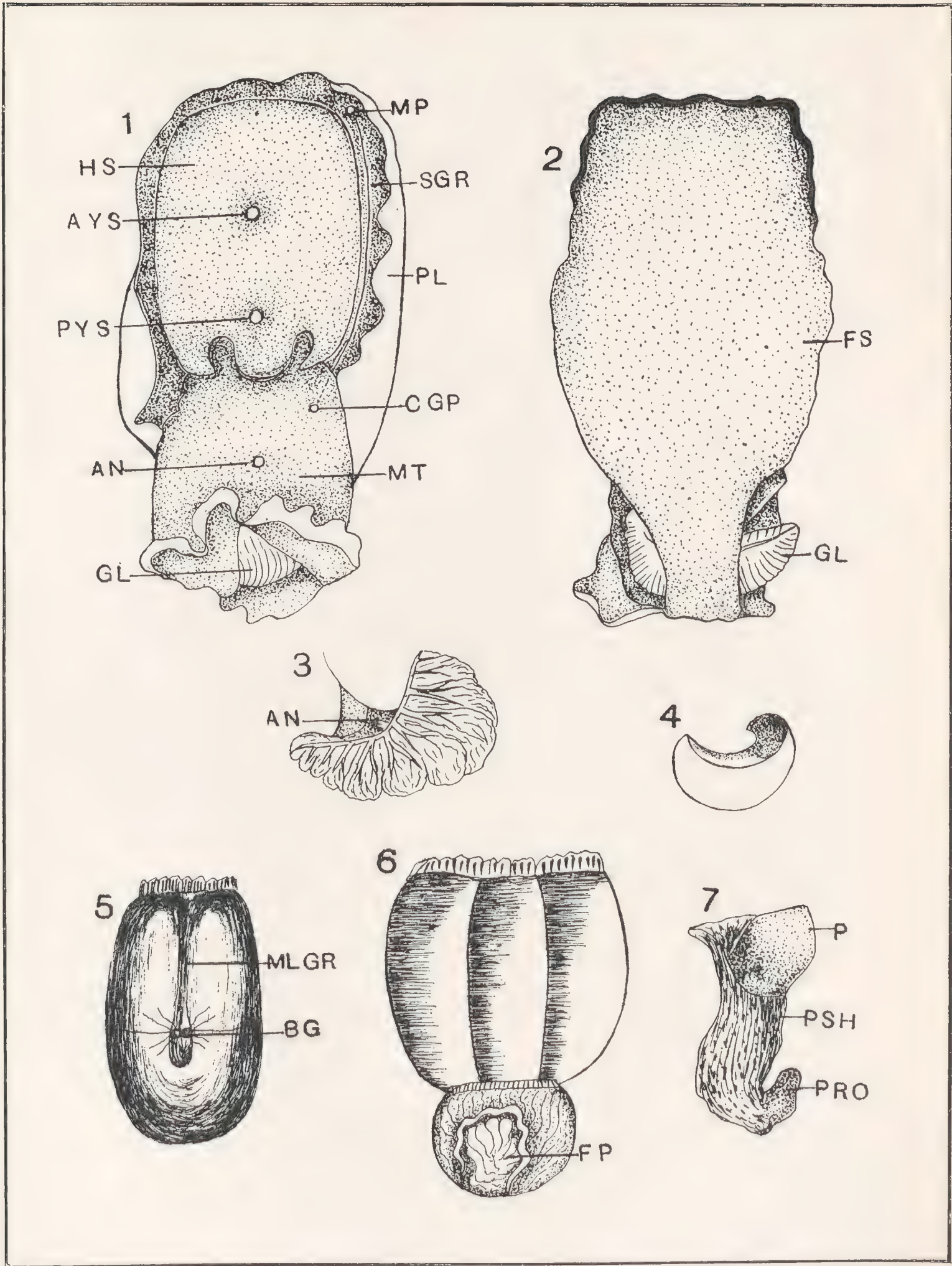
Gonad.—The ovotestis lies posteriorly to the liver and is closely attached to its posterior surface, but can be easily distinguished from the liver. The colour of the preserved specimen is somewhat blackish brown. The length of the ovotestis is 32 mm., breadth 22 mm., and thickness 11 mm.

Spermatheca.—The round spermatheca is situated near the right side of the liver, and its colour is ivory yellow. The maximum diameter of the spermatheca is 11 mm. The duct of the spermatheca is very long (about 22 mm.) and is so slender that unless due care be taken in dissecting it there is danger of its being cut through.

Male Genital Organ.—The blade-like penis (Pl. 11, f. 7, P) is fairly large in this species, and its length measures 14 mm. and its



See p. 261.



breadth 6 mm. The penis-sheath (Pl. 11, f. 7, PSH) is also fairly large according to the size of the penis. On the other hand, the so-called prostatic gland (Pl. 11, f. 7, PRO) is very small (about 4 mm. long and 2 mm. wide) and its colour is dark vinaceous grey.

Habit.—This species was found in shallow water (about 2 feet deep) near the Biological Station of the Tokyo Imperial University at Misaki on the 4th November, 1929.

There is only one species of *Aglaja* (*Aglaja giglioli* Tapparone-Canefri, 1874) known to be Japanese. I think *Aglaja iwasai* is to be clearly differentiated from it, the reasons being as follow:—

- (1) The shell is absolutely different.
- (2) The size of its body is much larger.
- (3) Its colour is different.
- (4) It has no flagellum or filament at the tip of the left separated lobe of the mantle.

Aglaja iwasai is different from all the known species of *Aglaja* and I dedicate it to Mr. Iwasa in gratitude for his kindness to me.

EXPLANATION OF PLATES.

PLATE 10.

Aglaja iwasai, sp. nov. Dorsal view, from a watercolour drawing made by Mr. Iwasa from the living animal at Misaki. The scale of the drawing was not indicated, but it is approximately double the size of preserved specimen.

PLATE 11.

FIG.

- 1.—Dorsal view of the preserved specimen. Nat. size. MP, male genital pore; SGR, spermatic groove; PL, parapodial lobe; CGP, common genital pore; MT, mantle; HS, head shield; AYS, anterior yellow spot; PYS, posterior yellow spot; AN, anus; GL, gill.
- 2.—Ventral view of the preserved specimen. Nat. size. FS, footsole.
- 3.—Side view of the gill. $\times \frac{1}{2}$. AN, anus.
- 4.—Shell. Nat. size.
- 5.—Ventral view of the pharyngeal bulb, showing the median large groove and the position of the buccal ganglia. Nat. size. MLGR, median large groove; BG, buccal ganglia.
- 6.—The pharyngeal bulb and the stomach have been slit lengthwise and opened out flat. Nat. size. FP, ear-like folded process on the inner wall of the posterior part of the stomach.
- 7.—The penis sheath has been slit somewhat lengthwise, showing the large penis. $\times 2$. P, penis; PSH, penis-sheath; PRO, so-called prostatic gland.

OBITUARY NOTICE

HENRY COATES, F.S.A., 1859-1935.

By JOHN RITCHIE.

HENRY COATES was born in Philadelphia, U.S.A., in December, 1859, the son of Mr. Andrew Coates, who was the American representative of the famous thread family at that time. Shortly after Mr. Coates's birth the family returned to Scotland, where his father commenced business on his own behalf as a carpet manufacturer in Perth. During his residence in America he was associated with many of the scientific men of eminence of that day, and gave financial assistance to Audubon towards the publication of his famous ornithological volume. The father's interests in natural history became strongly developed in his son, Henry. From his early boyhood Henry showed a natural penchant for the fauna and flora of the district in which he lived, and we find he became early associated with the Perthshire Society of Natural Science, which had among its members Geikie and Buchanan White. His interest in Geology was keen, and we find that while at Edinburgh University this class was the only one which seemed to offer him interest.

Returning after his University career to his home at Perth, he began a close study of the mollusca fauna of the district, and from time to time published his work, his earliest publication appearing in the *Transactions of the Perthshire Society of Natural Science*, on "The Mollusca of Perthshire," in 1882. This study he kept on right through his life, and during the last ten years he collated and catalogued the whole of the collections which were in the Perth Museum and at the same time collated and catalogued that of St. Andrews (Dundee University College). In the latter were the shells collected by Mrs. Carphin.

A few years before his death he had to seek a warmer climate for the benefit of his health, and removed to Torquay. Shortly before his death he was appointed President of the famous Society there. A week or two before his death he saw the publication of a booklet in which he had the collaboration of his wife on the Birds of Torquay.

During the war years he acted as Curator of the Perthshire Natural History Museum.

A man of unique personality, he became a member of the Conchological Society as far back as 1886. Mr. Coates was warm-hearted, sympathetic, and a most lucid lecturer who will be missed by many.

STUDIES OF AFRICAN LAND AND FRESH-WATER MOLLUSKS.

Notes on *Gonaxis* Taylor, with Description of a New Species.

By JOSEPH BEQUAERT¹ and WILLIAM J. CLENCH.²

(Read before the Society 11th May, 1935.)

Gonaxis Taylor.

THE generic name *Gonaxis* is here used to include all African Streptaxidæ with a more or less distorted spire, the body-whorl being shifted to one side of the axis, and without columellar and basal teeth or swellings. Thiele has recently proposed to rearrange the species partly on the basis of radular structure. Some of them he would place in *Tayloria*, some in a distinct genus *Afristreptaxis*, while the remainder he would unite with *Marconia* (see *Handbuch Syst. Weichtierk.*, ii, 1931, pp. 728–730; iii, 1934, p. 1010; *Arch. f. Molluskenk.* lxiv, 1932, pp. 11–12; *Sitzungsber. Ges. Naturf. Fr. Berlin*, 1933, pp. 280–3). Unfortunately very few of the species have been studied in this respect. Moreover, some of the published accounts of the radula are contradictory or erroneous. Thiele, for instance, states that there is no central tooth in *Gonaxis*, though the radula of the type species has never been examined. Of five West African species studied by Degner (1934, *Zool. Jahrb., Abt. Syst.*, lxxv, pp. 210–220), two showed a distinct central tooth, one a very small one, and two none at all. It would seem, therefore, that this peculiarity has hardly more than specific value.

Marconia is here retained for the shortly cylindric species, showing no distortion of the shell, and with very obtuse dome-like summit. No sharp line of demarcation can be drawn between *Marconia* and *Gonaxis* on shell characters alone. Pilsbry (1919, *Bull. Amer. Mus. Nat. Hist.*, xl, p. 173) attached great importance to the fact that in *Marconia lata ruwenzoriensis* Pilsbry the radula shows two zones of large laterals separated by a zone of smaller ones, on each side of the unarmed rachis. Since this feature was also found by Thiele in *Marconia latula* (Martens), it may be of more value than the mere absence or presence of the central tooth.³ Moreover, it should be pointed out that the genotype of *Marconia* is *Ennea lata*

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³ However, it is not shown in Connolly's figure of the radula of *Marconia margarita* (Preston), which, in addition, has a small central tooth (1922, *Ann. Mag. Nat. Hist.*, (9), x, p. 488).

Smith, as designated by Kobelt in 1906 (*Conch.-Cab.*, i, Abt. 12B, pt. 2, p. 167); not *Marconia gibbosa* Bourguignat, as given by Pilsbry. As a matter of fact, we place *M. gibbosa* in *Gonaxis*, since the shell is decidedly distorted.

When *Gonaxis* is eventually divided, the following names will become available :—

Gonaxis Taylor, 1877, *Quart. J. Conch.*, i, no. 12, p. 252. Monotypic for *Gonaxis gibbonsi* Taylor, 1877.

Pseudogonaxis Thiele, 1932, *Arch. f. Molluskenk.*, lxiv, p. 11. Type by original designation: *Streptaxis nsendweensis* Putzeys, 1899. Proposed as a subgenus of *Tayloria*.

Macrogonaxis Thiele, 1932, *Arch. f. Molluskenk.*, lxiv, p. 11. Type by original designation: *Streptaxis enneoides* Martens, 1878. Proposed as a section of *Pseudogonaxis*.

Afristreptaxis Thiele, 1932, *Arch. f. Molluskenk.*, lxiv, p. 12. Type by original designation: *Streptaxis vosseleri* Thiele, 1911. Proposed as a genus.

Eustreptaxis Pfeiffer (1879, *Nomenclator Helic. Viv.*, p. 15; the date 1878 printed on the wrapper of the first part is erroneous) does not seem to be available for the African species. The first valid type selection appears to be by Kobelt, in 1910 (*Jahrb. Nassau. Ver. Naturk.*, lxiii, p. 144), who designated *Helix contusa* Férussac of South America. H. B. Baker (1928, *Nautilus*, xli, p. 127) claims that Kobelt in 1880 (*Illustr. Conchylienbuch*, p. 209) selected the West African *Streptaxis nobilis* Gray, 1837, as the type. But Kobelt cited *two* species as the "types" of *Eustreptaxis*, one for the toothed and another for the toothless species; so that his action could hardly be regarded as a true type designation.

It seems to us that, on the strength of shell characters alone, *Gonaxis* divides rather naturally into two groups, as suggested by Pilsbry (1919, *Bull. Amer. Mus. Nat. Hist.*, xl, p. 171). If given subgeneric rank these groups might be characterized as follows :—

1. *Gonaxis* s.s. (Syn. *Pseudogonaxis*).—Last whorl much distorted shell considerably flattened. Small species, at most 13 mm. in length. This group contains: *albidus*, *blacklocki*, *cavallii*, *cressyi*, *denticulatus*, *gibbonsi*, *kirkii*, *maugeræ*, *mozambicensis*, *nsendweensis*, *percivali*, *pileolus*, *prostratus*, *pusillus*, *schweitzeri*, *souleyetianus*, and *welwitschii*.

2. Subg. *Macrogonaxis* (Syn. *Afristreptaxis*).—Last whorl very slightly or moderately distorted, the shell globosely conoid: Usually large species, exceptionally 10 mm. in length (*johnstoni*, *turbinatus*). This group contains: *abessinicus*, *æthiopicus*, *bloyeti*, *bottegoi*, *breviculus*, *camerunensis*, *craveni*, *elongatus*, *enneoides*, *gibbosa*, *gwandaensis*, *johnstoni*, *kibweziensis*, *loveridgei*, *mamboiensis*,

micans, *monrovia*, *quadrilateralis*, *sudanicus*, *turbinatus*, *ukamicus*, *vengoensis*, *vosseleri*, and *vulcani*.

We have seen no species that could not be placed readily in either of these groups.

The following species, based upon immature shells, are doubtful *Gonaxis*: *bethencourti*, *inermis*, and *pupilla*.

No revision of *Gonaxis* is here attempted. We shall merely list the species which we believe should be included in the genus.

G. abessinicus (Thiele).—*Afristreptaxis abessinicus* Thiele, 1933, *Sitzungsber. Ges. Naturf. Fr. Berlin*, p. 288, pl. 1, fig. 2 (Abyssinia, without more definite locality).

G. æthiopicus (Thiele).—*Afristreptaxis æthiopicus* Thiele, 1933, *Sitzungsber. Ges. Naturf. Fr. Berlin*, p. 287, pl. i, figs. 2–2a (Dalba, Djimma, Buka Mts., Anderatscha-Detscha, Kella Mts., Upper Gelo River, all in Abyssinia). With var. *minor* Thiele, loc. cit.

G. albidus (Pfeiffer).—*Streptaxis albida* Pfeiffer, 1845, in Philippi, *Abb. Besch. Conchyl.*, ii, p. 7; 1846, loc. cit., ii, p. 128, pl. viii, *Helix*, fig. 5 (type; locality unknown). Unrecognized. Germain (1911, *Bull. Mus. Hist. Nat. Paris*, xvii, p. 229) regards *G. prostratus* (Gould) as being the same species.

G. (?) bethencourti (Nobre).—*Streptaxis bethencourti* Nobre, 1905, *Ann. Sci. Nat. Porto*, ix, p. 104, pl. i, figs. 33–4 (forests of Mupépé, Angola). This was based upon an immature shell, 6 by 7 mm., of doubtful generic relationship.

G. blacklocki Connolly, 1928, *Ann. Mag. Nat. Hist.*, (10) i, p. 531, figs. 1a–b, Jama [type loc.], Langranna, Majendoo, all Sierra Leone. We have seen it from Liberia, Bonuta, Kolobanu, Memeh Town, Banga, Gbanga.

G. bloyeti Bourguignat, 1889, *Moll. Afr. Équat.*, p. 134, pl. vii, figs. 1–3 (mountain range between Usagara and Ugogo, Tanganyika Territory). We have seen it from Ukami, Tanganyika Territory.

G. bottegoi (Martens).—*Streptaxis bottegoi* Martens, 1895, *Ann. Mus. Civ. Genova*, xxxv, p. 63 (between Bardera and Brava, Italian Somaliland); 1897, *Deutsch Ost-Afr.*, IV, Besch. Weichth., p. 31, pl. ii, fig. 28 (type). Not seen.

G. breviculus (E. A. Smith).—*Gibbus* (*Gonidomus*) *breviculus* E. A. Smith, 1890, *Ann. Mag. Nat. Hist.*, (6) vi, p. 161, pl. vi, fig. 3 (Usagara, Tanganyika Territory). Not seen.

G. camerunensis (d'Ailly).—*Streptaxis camerunensis* d'Ailly, 1896, *Bih. Svensk. Vet. Ak. Handl.*, xxii, Afd. iv, No. 2, p. 5, pl. i, figs. 1–5 (Bonge and Bibundi, Cameroon). We have seen a paratype from Bonge and also specimens from Idenau, near Victoria, Cameroon.

G. cavallii (Pollonera).—*Streptaxis cavallii* Pollonera, 1906, *Boll. Mus. Zool. Anat. Comp. Torino*, xxi, no. 538, p. 2 (eastern slope of Mt. Ruwenzori, in the Mobuku Valley, 2,000 m., Uganda);

1909, *Il Ruwenzori, Rel. Scientif.*, i, p. 183, pl. xx, fig. 1 (type). We have seen it from Mt. Ruwenzori in the Butagu [or Butahu] Valley, 1,800 to 2,200 m., Belgian Congo.

G. craveni (E. A. Smith).—*Streptaxis craveni* E. A. Smith, 1880, *Ann. Mag. Nat. Hist.*, (5) vi, p. 429 (on the hills between the mouth of the Dana [= Tana] River and Mombasa, Kenya Colony); 1881, *Proc. Zool. Soc. London*, p. 280, pl. xxxii, figs. 5–5a (type). We have seen it from Kizerui and Amani, in Usambara, Tanganyika Territory; and from Mt. Mbololo in the Taita Mts., Kenya Colony.

G. cressyi Connolly, 1922, *Ann. Mag. Nat. Hist.*, (9) x, p. 113 (Mtisherra River Valley, Portuguese East Africa); 1925, *Trans. Roy. Soc. South Africa*, xii, pt. 3, p. 110, pl. iv, fig. 1 (type). Not seen. This appears to be very close to *G. mozambicensis* (Smith), a species not mentioned by Connolly.

G. denticulatus (Dohrn).—*Streptaxis denticulatus* H. Dohrn, 1878, *Jahrb. D. Malak. Ges.*, v, p. 152 (Mombasa, Kenya Colony). Syn. *Streptaxis ordinarius* E. A. Smith, 1890, *Ann. Mag. Nat. Hist.* (6) vi, p. 160, pl. vi, figs. 2–2a (Mamboya, 4,000–5,000 feet, Tanganyika Territory). Not seen. Dohrn's type was not figured. Thiele (1911, *Wiss. Ergebn. D. Z. Afr. Exp.*, iii, p. 186) synonymized Smith's *ordinarius* after comparing cotypes of both species.

G. elongatus (Fulton).—*Streptaxis elongatus* Fulton, 1899, *Proc. Mal. Soc. London*, iii, pt. 6, p. 302, fig. ii (locality unknown). Connolly has recently reported it from Portuguese East Africa. We have seen several specimens collected by Dr. J. Sandground in Southern Rhodesia (Mt. Selinda or Chirinda). Two of these are figured (Figs. 4 and 5). The peculiar sculpture was incompletely described by Fulton, which led us to think that our shells belonged to a new form. Beginning with the second nuclear whorl, the shell is covered with rather fine, oblique, axial ribs, very regularly spaced (5 to the mm. on the body whorl); between these axial ribs there are numerous, much finer, spiral riblets only visible with an $8\times$ power lens; the surface does not appear reticulate owing to the difference in height of the two kinds of ribs. Our shells measure: Length 24.0 and 23.6 mm.; greater diameter, 14.5 and 15.4 mm.; lesser diameter, 13.0 and 13.5 mm.; aperture, 9.0 by 7.0 and 8.5 by 7.2 mm.

G. enneoides (Martens).—*Streptaxis enneoides* Martens, 1878, *Monatsber. Ak. Wiss. Berlin*, p. 295, pl. ii, figs. 5–6 (Ukamba, Tanganyika Territory). We have seen it from Amani, Tanganyika Territory.

G. gibbonsi Taylor, 1877, *Quart. J. Conch.*, i, no. 12, p. 252, pl. 11, fig. 1 (Zanzibar). We have seen specimens collected in the Island of Zanzibar by C. Cooke.

G. gibbosa (Bourguignat).—*Marconia gibbosa* Bourguignat, 1889,

Moll. Afr. Équat., p. 137, pl. vii, figs. 6-7 (between Kondoa and Mpwapwa in Usagara ; and between Dyaza and Ibahi in Ugogo ; both in Tanganyika Territory). Syn. *Streptaxis* (*Eustreptaxis*) *marconi* Gude, 1902, *Proc. Mal. Soc. London*, v, pt. 3, p. 205 (new name). Not seen. *Marconia gibbosa humilior* Pilsbry (1919, *Bull. Amer. Mus. Nat. Hist.*, xl, p. 175, fig. 62*b*), of the Belgian Congo, is in our opinion a species of *Marconia*, probably not separable from *M. vitrea* (Morelet) and *M. gaudioni* (Dupuis and Putzeys).

G. gwandaensis (Preston).—*Streptaxis gwandaensis* Preston, 1912, *Ann. Mag. Nat. Hist.*, (8) ix, p. 69, fig. 1 (near the Geelong Mine, Gwanda district, Southern Rhodesia). Not seen. Also reported from Portuguese East Africa.

G. inermis (Morelet).—*Helix inermis* Morelet, 1864, *J. de Conchyl.*, xii, p. 157 (Sierra Leone). According to Connolly an immature, moderately large *Gonaxis*.

G. johnstoni (E. A. Smith).—*Streptaxis johnstoni* E. A. Smith, 1899, *Proc. Zool. Soc. London*, p. 581, pl. xxxiii, figs. 5-6 (Nyika Range and Zomba Plateau, Nyasaland). Not seen.

G. kibweziensis (E. A. Smith).—*Streptaxis kibweziensis* E. A. Smith, 1894, *Proc. Mal. Soc. London*, i, pt. 4, p. 165, fig. 1 (Kibwezi, Kenya Colony). We have seen it from Kibwezi, Voi, the Taru Desert, Mt. Mbololo in the Taita Mts., all in Kenya Colony, and from Kibosho at the foot of Mt. Kilimanjaro, Tanganyika Territory. The name was misspelled *kilweziensis* by Kobelt in 1910 (*Abh. Senckenb. Naturf. Ges.*, xxxii, p. 57).

G. kirkii (Dohrn).—*Streptaxis kirkii* Dohrn, 1865, *Proc. Zool. Soc. London*, p. 232 (Mumba Island in Lake Nyasa, Nyasaland). E. A. Smith, 1899, *Proc. Zool. Soc. London*, p. 582, pl. xxxiii, figs. 7-8 (specimen from Zomba Plateau, Nyasaland). Not seen. Also reported from Portuguese East Africa.

G. loveridgei Bequaert and Clench.—See below.

G. mamboiensis (E. A. Smith).—*Streptaxis mamboiensis* E. A. Smith, 1890, *Ann. Mag. Nat. Hist.*, (6) vi, p. 160, pl. vi, fig. 1 (Mamboya, 4,000-5,000 feet, Tanganyika Territory). The name was misspelled *mambojensis* by Kobelt in 1905 (*Conch.-Cab.*, i, Abt. 12B, pt. 2, p. 8), and *mambodschensis* by Kobelt in 1910 (*Jahrb. Nassau. Ver. Naturk.*, lxiii, p. 171). Not seen.

G. maugeræ (J. E. Gray).—*Streptaxis maugeræ* J. E. Gray, 1837, *Mag. Nat. Hist.*, i, p. 486, figs. *c-d* (on p. 485, Sierra Leone). Syn. *Streptaxis mangeræ* Petit, 1841, *Rev. Zool. Soc. Cuvier.*, p. 99. We have seen specimens from Liberia, Memeh Town, Kolobanu, Betala, Paiata, Bonuta, Kakatown to Gbanga, Banga, Du River, Cape Palmas. The species is also known from French Guinea.

G. micans (Putzeys).—*Streptaxis micans* Putzeys, 1899, *Ann. Soc. Mal. Belgique*, xxxiv, *Bull. Séances*, p. lv, fig. 2 (Waregga Forest

in the Manyema district, Belgian Congo). We have seen specimens from Nsendwe (named by Dupuis), Stanleyville, and Sitaweza (between Walikale and Lubutu), all in the Belgian Congo. *G. micans* mut. *apertus* Pilsbry, 1919, *Bull. Amer. Mus. Nat. Hist.*, xl, p. 178, fig. 64c (Stanleyville, Belgian Congo) we have seen from the village of Malela (chief Kasende, S. of Pania Mutombo), Belgian Congo.

G. monrovia (Rang).—*Helix monrovia* Rang. 1831, *Ann. Sci. Nat.*, xxiv, p. 16, pl. iii, fig. 3 (Cape Mesurado on the coast of Malaguetto = Monrovia, Liberia). Syn. *Streptaxis nobilis* J. E. Gray, 1837, *Mag. Nat. Hist.*, i, p. 486, figs. *a-b* (Sierra Leone). *Helix blandigiana* Is. Lea, 1840, *Proc. Amer. Phil. Soc.*, i, p. 175; 1841, *Trans. Amer. Phil. Soc.*, vii, p. 459, pl. xii, fig. 9 (type; banks of the St. Paul River, Liberia). *Helix reclusiana* Petit, 1841, *Rev. Zool. Soc. Cuvier.*, p. 99 (one of the islands off the coast of Guinea). *Streptaxis reclusiana* Pfeiffer, 1868, *Monogr. Helic. Viv.*, v, p. 440, *Helix rimata* Pfeiffer, 1847, *Zeitschr. f. Malak.*, iv, p. 48 (without locality). *Streptaxis monroviana* Pfeiffer, 1876, *Novit. Conchol.*, v, p. 26, pl. cxlii, figs. 1-6 (Liberia). We have seen it from Liberia, where it is very common, Cape Palmas, near Trade Town, Bassa County, Paiata, Banga, Du River, Monrovia, Gbanga, Kakatown, Zanschue to Suah Koko. It is also known from French Guinea, Sierra Leone, and the Ivory Coast. *Streptaxis nobilis* var. *minor* Germain, 1912, *Bull. Mus. Hist. Nat. Paris*, xviii, p. 254 (Roum Island, near Konakry, French Guinea), was based upon specimens 13.75 to 16 mm. high and 11.75 to 12 mm. in greater diameter. This seems to represent an unusually dwarfed race, even though the species varies considerably in size in the same locality. Our smallest Liberian specimen measures: Height, 15.6 mm.; greater diameter, 15.4 mm.; our largest: height, 35.5 mm.; greater diameter, 25.5 mm.

G. mozambicensis (E. A. Smith).—*Streptaxis mozambicensis* E. A. Smith, 1880, *Ann. Mag. Nat. Hist.*, (5) vi, p. 429 (between Lake Nyasa and the East Coast of Africa); 1881, *Proc. Zool. Soc. London*, p. 280, pl. xxxii, figs. 6-6a (type). Not seen. This species came probably from the northern part of Portuguese East Africa. It is about the size of *G. cressyi* Connolly, which should be compared with it (*cressyi*: Height, 6.2 mm.; greater diameter, 3.8 mm.; *mozambicensis*: Height, 7.5 mm.; greater diameter, 4.5 mm.).

G. nsendweensis (Putzeys).—*Streptaxis nsendweensis* Putzeys, 1899, *Ann. Soc. Mal. Belgique*, xxxiv, *Bull. Séances*, p. lv, fig. 3 (Nsendwe, Belgian Congo). Originally misspelled "*nseudweensis*", the specific name was corrected in print by Dupuis and Putzeys in 1900, in an abstract of a paper (p. xix); but the correction does not seem to occur in the periodical itself. We have seen paratypes from Nsendwe and specimens from Mpala, Belgian Congo.

G. percivali (Preston).—*Streptaxis percivali* Preston, 1913, *Proc. Zool. Soc. London*, p. 194, pl. xxxii, fig. 4 (northern slopes of Mt. Marsabit, Kenya Colony). Syn. *Streptaxis woodhousei* Preston, 1913, *Proc. Zool. Soc. London*, p. 194, pl. xxxii, fig. 5 (Mt. Elgon, Uganda). We have seen several paratypes of *S. woodhousei* and others from the Yala district, Kenya Colony. We agree with Germain that *woodhousei* is not separable from *percivali*.

G. pileolus Connolly, 1928, *Ann. Mag. Nat. Hist.*, (10) i, p. 532, figs. 2a–b (Langranna [type loc.] and Majendoo, Sierra Leone). We have seen a specimen from Liberia (Gbangba).

G. prostratus (Pfeiffer).—*Streptaxis (Artemon) prostrata* “Gould” Pfeiffer, January, 1856, *Malak. Blätter*, ii (1885), p. 172, footnote (Cape Palmas, Liberia). Gould, October, 1856, *Proc. Boston Soc. Nat. Hist.*, vi, pt. 1, p. 12 [“*Streptaxis prostrata* Gould”, in Jay, 1850, *Cat. Shells Coll.*, 4th ed., p. 117, is a *nomen nudum*]. Tryon, 1885, *Man. of Conch.*, (2) i, p. 69, pl. xxvii, fig. 9 (figure of a cotype or topotype). This species is common in Liberia, Cape Palmas, Bonuta, Kasata, Kolobanu, Moala, Gbangba, Du River.

G. (?) pupilla (Morelet).—*Streptaxis pupilla* Morelet, 1887, *J. de. Conchyl.*, xxxv, p. 283, pl. ix, fig. 2 (Great Comoro Id.). This is possibly an immature *Gonaxis*, although more probably a young *Marconia*.

G. pusillus (Martens).—*Streptaxis pusillus* Martens, 1897, *Deutsch Ost-Afr.*, “IV, Besch. Weichth.,” p. 32, pl. ii, fig. 31 (“Bukendo on the Ituri River,” Belgian Congo; this was probably a misspelling for Bukende on the Itiri or Semliki River, in 0° 50' N., 29° 50' E.). Syn. *Gonaxis cavallii ituriensis* Pilsbry, 1919, *Bull. Amer. Mus. Nat. Hist.*, xl, p. 177, figs. 63 c–c' (Penge [type loc.], Avakubi, Lesse, Rutshuru, all in the Belgian Congo). We have seen paratypes of *ituriensis* from all localities listed by Pilsbry.

G. quadrilateralis (Preston).—*Ennea quadrilateralis* Preston, 1910, *Ann. Mag. Nat. Hist.*, (8) vi, p. 527, pl. vii, fig. 2 (Shimbi [= Shimba or Simba] Hills, Kenya Colony). Syn. *Streptaxis craveni* var. *minor* Germain, 1918, *Bull. Mus. Hist. Nat. Paris*, xxiv, p. 252 (Zanzibar Island). Preston's species was described as “sculptured with moderately fine, very closely set, arcuate, transverse striæ”; and the paratype examined by Germain showed a similar sculpture. *E. quadrilateralis* could, therefore, not possibly be identical with *G. craveni*, which is smooth except for the close crenulation below the suture. Since Germain compares his *S. craveni* var. *minor* with a paratype of *E. quadrilateralis*, we surmise that his *minor* was a small specimen of Preston's species and not of *G. craveni*. We have not seen the species.

G. schweitzeri (Dohrn).—*Streptaxis schweitzeri* H. Dohrn, 1878, *Jahrb. D. Malak. Ges.*, v, p. 153 (Sokon, Liberia). *Gonaxis*

schweitzeri Degner, 1934, *Zool. Jahrb. Abt. Syst.*, lxxv, p. 212, fig. 2a (type). The status of this species is left open to discussion by Degner. We believe we have recognized it in two specimens from Lenga Town, Liberia, which are only 9 mm. in length, for 6 to $6\frac{1}{2}$ whorls, and have the umbilicus completely closed.

G. souleyetianus (Petit).—*Helix souleyetiana* Petit, 1841, *Rev. Zool. Soc. Cuvier.*, p. 99 (supposedly from the Seychelles). *Streptaxis souleyetiana* Pfeiffer, 1846, in Philippi, *Abb. Besch. Conchyl.*, ii, p. 130, pl. viii, *Helix*, fig. 6 (not the type). Syn. *Helix dussumieri* "Férussac" Dufo, 1840, *Ann. Sci. Nat. Zool.*, (2) xiv, p. 199 (Mahé; without description). Known from the Seychelles only. We have seen it.

G. sudanicus (Preston).—*Streptaxis sudanica* Preston, 1914, *J. Linn. Soc. London Zool.*, xxxii, p. 265, pl. xviii, figs. 15–16 (Sheik Tombé on the Bahr-el-Gebel [below Lado], Anglo-Egyptian Sudan). Not seen.

G. turbinatus (Morelet).—*Streptaxis turbinata* Morelet, 1867, *Voy. Welwitsch. Moll. Terr. Fluv.*, (1868), p. 58, pl. i, fig. 8 (District of Icolo and Bengo, on the shore of Lake Quilonda, Portuguese West Africa). Not seen.

G. ukamicus (Thiele).—*Streptaxis ukamica* Thiele, 1911, *Wiss. Ergebn. D. Z. Afr. Exp.* (1907–8), iii, p. 185, pl. iv, figs. 25–6 (Ukami Mountains, Tanganyika Territory). We have seen it from Nyange (Uluguru Mountains), Tanganyika Territory.

G. vengoensis Connolly, 1922, *Ann. Mag. Nat. Hist.*, (9) x, p. 114 (District 15 miles N. of Macequece, Portuguese East Africa); 1925, *Trans. Roy. Soc. South Africa*, xii, pt. 3, p. 115, fig. 2, pl. iv, fig. 2 (type). Not seen.

G. vosseleri (Thiele).—*Streptaxis vosseleri* Thiele, 1911, *Wiss. Ergebn. D.Z. Afr. Exp.* (1907–8), iii, p. 185, fig. ix, pl. iv, fig. 27 (Amani in Usambara and Tanga; both in Tanganyika Territory). We have seen it from Lutindi (Usambara Mountains), Tanganyika Territory.

G. vulcani (Thiele).—*Streptaxis vulcani* Thiele, 1911, *Wiss. Ergebn. D.Z. Afr. Exp.* (1907–8), iii, p. 184, fig. viii, pl. iv, figs. 22–3 (Mt. Ninagongo at 2,500 to 3,000 m., Belgian Congo). Syn. *Ennea buccina* Preston, 1913, *Proc. Zool. Soc. London*, p. 196, pl. xxxii, fig. 11 (Burunga at the foot of Mt. Mikenno, at 6,000 feet Belgian Congo). We have seen numerous specimens from Burunga, Mt. Ninagongo (at 9,000 feet), Tshibinda, and Luvunu, near Masisi; all localities in the Kivu highlands of the Belgian Congo. A study of this series shows that *buccina* was based upon a mere individual variation of *vulcani*.

G. welwitschii (Morelet).—*Streptaxis welwitschii* Morelet, 1867, *Voy. Welwitsch, Moll Terr. Fluv.* (1868), p. 57, pl. i, fig. 7 (on the

shores of Lake Moembege, district of Cazengo, Portuguese West Africa).—Connolly records the species from Sierra Leone. We have seen one specimen from Kakatown to Gbanga, Liberia, which agrees well with the original description and figure.

Gonaxis (Macrogonaxis) loveridgei, new species. Figs. 1, 2, 3.

Description.—Shell globosely conoid, rather thin, imperforate, shiny, little depressed dorso-ventrally and slightly oblique. Colour of periostracum bronze green. Whorls six, slightly convex. Spire regularly convex ; body whorl distinctly but moderately thrown to one side of the axis, about three-fourths of the length of the shell. Summit dome-shaped, obtusely rounded. Aperture subquadrate, somewhat inwardly oblique. Outer lip white, narrow, and slightly reflected, connected directly with the parietal wall, without intervening notch. A small thickened deposit, mere indication of a parietal tooth, on the body whorl just within the end of the outer lip. Columella nearly straight and somewhat thickened, forming a plate behind and attached to the inner lip, which ends directly on the body whorl and is not a continuation of the columella. Sutures not very deeply impressed. Sculpture : Nuclear whorl smooth and glossy ; next whorl at first with a faint indication of ribbing, which changes rather abruptly to a definite sculpture of numerous fine, slightly oblique, axial ridges covering the remainder of the shell ; the ridges not forming crenulations at the sutures.

MEASUREMENTS.

Length	Greater Diameter	Lesser Diameter	Height of Aperture	
mm. 21·5	mm. 15·5	mm. 12·5	mm. 8·5	Holotype. Fig. 2.
25·0	17·0	14·5	10·5	Paratype.
21·5	14·0	13·0	8·5	Paratype.
21·5	14·0	13·0	7·5	Paratype.

Holotype.—Museum of Comparative Zoölogy, No. 59915, Bagilo, Uluguru Mountains, 5,000 feet, Tanganyika Territory (Arthur Loveridge, 1926). Paratypes from Vituri, 2,500 feet, and Bagilo, Uluguru Mountains. Same collector.

Remarks.—A rather distinctive species, due to the somewhat aberrant edge of the inner lip and columella. In most other species seen by us the columella continues evenly and without any line of

demarcation with the lip ; whereas in *G. loveridgei* the lip originates above the columella on the body whorl, while the columella itself forms a thickened plate just behind and joined to it. The most nearly allied form appears to be *G. ukamicus* (Thiele), but this has a very smooth surface, is more oblique, and has a fully developed parietal tooth. From the description and figure, *G. quadrilateralis* (Preston) also appears to be similar, but that species has a distinct notch at the junction of the outer lip with the parietal wall and lacks the plate-like thickening of the columella.



FIGS. 1-3.—*Gonaxis loveridgei* Bequaert and Clench. Bagilo. Natural size. Fig. 2 is the holotype.



FIGS. 4 and 5.—*Gonaxis elongatus* (Fulton). Mt. Selinda. Natural size.

Lamelliger Ancey.

Streptaxis section *Lamelliger* Ancey, 1884, *Le Naturaliste*, vi, p. 399. Monotypic for *Helix troberti* Petit, 1841.

We agree with Degner (1934, *Zool. Jahrb. Abt. Syst.*, lxxv, p. 220) that this group should be given full generic rank. The shell is characterized by the presence of two pits on the body whorl, just behind the outer lip, with corresponding immersed basal swellings, and of columellar swellings or teeth. There is a long, sinuous parietal lamella, deeply entering the aperture. In addition the animal shows several important anatomical features and the inner lateral teeth of the radula are unusually wide, with very broad basal plates. The genus is strictly West African.

There is a possibility that the name *Lamelliger* will be replaced by *Odontartemon* Pfeiffer, January, 1856, *Malak. Blätter*, ii (1855), p. 172 (as a subgenus of *Streptaxis*, for several species, including *distorta* Jonas, *troberti* Petit, *dejecta* Petit, etc.). The first type designation seems to have been made by Kobelt in 1880 (*Illustr. Conchylienbuch*, p. 209), who selected *Helix distorta* Jonas, 1843. Whether Kobelt intended to designate true genotypes in this work is, however, open to question. Ancey in 1884 (*Le Naturaliste*, vi, p. 508) designated *Helix dejecta* Petit, 1842, as type of *Odontartemon*. The following species are included :—

L. distorta (Jonas).—*Helix (Streptaxis) distorta* Jonas, 1843, in *Philippi, Abb. Beschr. Conchyl.*, i, p. 48, pl. iii, *Helix*, fig. 3 (Guinea). Not recognized.

L. maassi Degner, 1934, *Zool. Jahrb. Abt. Syst.*, lxxv, p. 224, figs. 11a–c (radula and anatomy; type not figured); Tammassadou and Gueckédou, French Guinea, Porruma, Liberia.

L. troberti (Petit).—*Helix troberti* Petit, 1841, *Rev. Zool. Soc. Cuvier.*, p. 100 (coast of Guinea). *Streptaxis troberti* Morelet, 1867, *Voy. Welwitsch, Moll. Terr. Fluv.*, (1868), p. 58, pl. i, fig. 6 (not the type). Syn. *Streptaxis leonensis* Pfeiffer, 1859, *Monogr. Helic. Viv.*, iv, p. 333 (Sierra Leone). Gude, 1902, *Proc. Mal. Soc. London*, v, pt. 3, p. 225, pl. iv, figs. 1–3 (type). Known from Portuguese Guinea, Sierra Leone, French Guinea, Liberia, and Angola.

Through the kindness of Dr. E. Degner, the Museum of Comparative Zoölogy has recently received from the Hamburg Museum specimens of both *L. maassi* and *L. troberti*.

MOLLUSCA DESTROYED BY FROST.

By J. R. LE B. TOMLIN.

(Read before the Society, 7th Nov., 1936.)

LAST year I visited the Loch of Harray, on the Orkney Mainland, in July, as mentioned in Professor Boycott's article, "*N. fluviatilis* in Orkney." ¹

That species and *Hydrobia jenkinsi* were to be seen alive in the utmost abundance on small stones—the *Neritina* completely covered by a white limy deposit with comparatively few exceptions, the *Hydrobia* all clean and normal.

This year, also in July, I had an opportunity of revisiting the

¹ This *Journal*, vol. 20, p. 199.

ground and found both species extremely scarce living, and that in the same locus to which I paid particular attention in 1935, a few yards of shore close to the Bridge of Brodgar. Dead shells were plentiful and it seemed pretty clear that some unusual factor had been at work to wipe them out wholesale. The water at the edge of the Loch is extremely shallow, not more than a very few inches deep for some little way out, and the whole Loch though $4\frac{1}{2}$ miles long nowhere attains a greater depth than 14 feet.

This shallowness at once suggested possibilities of freezing, and I had recourse to our member, Mr. Robert Rendall, of Kirkwall, who is such a mine of knowledge about anything Orcadian. It is to him that I am indebted for practically all the following data, and through him to Mr. Muir, of the Kirkwall Meteorological Station.

There were two special periods of frost in Orkney last winter—an exceptionally severe one in the first week of February last, and a rather severe one exactly a month later.

On 5th February the minimum temperature was 23 degrees and 9 degrees on the grass, and on 2nd and 3rd March 30 degrees, with a grass minimum of 24 degrees. In either case the spell lasted for three days.

Mr. Spence, of Brodgar, confirms the severity of these spells, and says that Harray was completely frozen over right up to the dykes, and Stenness likewise except for a small piece at the Bridge of Brodgar and the outlet at the Brig o' Waithe.

During the second period of frost several swans which had stayed too long in the water were solidly frozen in and died, though men tried to release them with long poles. Mr. Spence, who has lived there for twelve years, does not recall any frost as severe as these two periods: he states that Harray was frozen solid at the edge and could be walked on without risk. Though the February temperatures as given above were lower, yet the ground was frozen further down in March.

It is, I think, a fair inference that last winter is responsible for the present scarcity of the snails.

EARLY RECORDS OF LANCASHIRE AND CHESHIRE NON-MARINE MOLLUSCA, BY JAMES WRIGHT WHITEHEAD.

By NORA FISHER and J. W. JACKSON, D.Sc., F.G.S.

(Read before the Society, 14th March, 1936.)

RECENTLY an old conchological diary covering the years 1841-1858 came to light in Liverpool Public Museums, and by the courtesy of Dr. Douglas A. Allan, the Director, we have been permitted to make use of it in the following account.

The diary is obviously the work of a Liverpool conchologist, and with very few exceptions the localities referred to are in the Mersey-side area.

The diary itself is an ordinary exercise-book with marbled covers. It begins "Memoranda and Observations regarding Natural History, etc.", but deals only with mollusca. The entries run from September, 1841, to June, 1858, and cover 26 pp. They are concerned chiefly with land and freshwater mollusca, but include some marine species from various Lancashire and Cheshire localities, and with these we hope to deal later in another paper. At the back of the book are miscellaneous notes regarding the preservation of mollusks, and also a copy of a letter from the author of the diary to a friend. This letter is signed "J. W. W." Search was made for any mention of a conchologist whose initials were J. W. W. and who flourished between about 1840 and 1860. At last (*Proc. Lit. & Phil. Soc. Liverpool*, no. 14, p. 1, 1859) a notice of the death of James Wright Whitehead was found. Whitehead, who died in the winter of 1858-9, was a good conchologist, and is frequently quoted by Byerley in his "Fauna of Liverpool" (*Proc. Lit. & Phil. Soc. Liverpool*, no. 8, Appendix, 1854). He became a member of that society on 18th May, 1857, and was then living at 15 Duke Street, Edge Hill, just outside Liverpool. By occupation he was a merchant, of the firm of Whitehead and Meyer, who had premises in Orange Court, Castle Street, Liverpool. It is not known how Whitehead's diary came to be in Liverpool Museums, for no trace of his collection of shells, which is said to have been a good one, can be found there, but it is possible that they were incorporated with the general collection without any distinguishing mark.

The following localities referred to in the diary are on the outskirts of Liverpool: Crosby, Edge Hill, Huyton, Low Hill, Mosley Vale, Roby, Speke, Toxteth Park, and Wavertree.

That Whitehead collected widely in Wirral is shown by the long list of Wirral localities mentioned by him: Bebington, Bidston, Brimstage, Bromborough Pool, Greasby, Higher Tranmere, Hoylake, Leasowe, Liscard, New Brighton, New Ferry, Parkgate,

Saughall, Stourton Hill, Sutton, Upton, Wallasey, and Woodchurch. The context shows that the "Upton" so often mentioned is the Wirral place of that name, not the one near Chester.

Some of the localities to which Whitehead refers are now historic having been built over or otherwise destroyed as far as molluscan life is concerned, but probably many of the species he mentions still live in the localities where he collected them over eighty years ago. In this connection may we appeal for information as to the present status in any of his localities of any species listed by Whitehead?

In the following list of records the arrangement and nomenclature followed are those of Kennard and Woodward in *Synonymy of the British Non-Marine Mollusca* (1926).

LIST OF RECORDS.

- Acme lineata* (Drap.). "*Acme fusca*. Patrick's Wood, Bromboro' Pool, between high road and railway, 1856. Mr. Cameron."
- Viviparus viviparus* (L.). "*Paludina vivipara*. Very fine, from the Shropshire Canal at Chrislington [Christleton], near Chester, July, 1857."
- "*Paludina achatina* (Gray). Mersey and Dee Canal, Mollington to Ellesmere Locks, Saughall Bridge only, Aug. 24, 1852."
- Viviparus fasciatus* (Müll.). "*Paludina listeri*. Drain, Scarsbrick Road, Southport, Sept., 1850."
- Bithynia tentaculata* (L.). "*Bythinia tentaculata*. Rivulet from well near Grange-hill, Hoylake, July, 1849. Pit nr. brickfields, Low Hill, May, 1850. Ditches and drains, Southport, 1850."
- "*Bythinia impura*. Ditch, Leasowe, June 16, 1851. Pits at Sutton. Plentiful, July 18, 1851."
- Valvata piscinalis* (Müll.). "*Valvata piscinalis*. Rivulet from well near Grange-hill, Hoylake, July, 1849. Ditches and drains, Southport, Sept., 1850. Leeds and Liverpool Canal from Kirby to Litherland, July 23, 1852. Leeds and Liverpool Canal between Linacre Bridge and Sandhills Bridge, May 9, 1853. Large, at Saughall, May-Aug., 1856."
- Valvata cristata* (Müll.). "*Valvata cristata*. Leasowe, May-Aug., 1856."
- Carychium minimum* (Müll.). "*Carychium minimum*. Amongst decayed leaves at 'Greenwood', Bebbington, June, 1850. Garden-fence, Huyton, May-Aug., 1851."
- Phytia myosotis* (Drap.). "*Conovulum denticulatum*. Vegetation on mud banks, Bromboro' Pool, Aug., 1850."
- "*Conovulus denticulatus*. Entrance to Bromboro' Pool, May-Aug., 1856."

Limnæa stagnalis (L.). "*Lymnæa stagnalis*. Drains on the Marsh, Hoylake, July, 1849. Pits, Edge Hill, May, 1850. Toxteth Park, plentiful, May, 1850. Blackpool, Aug., 1851."

Limnæa auricularia (L.). "*Lymnæa auricularia*. Young from pond in Mr. Evans's garden, Prescott, June-July, 1850."

Limnæa pereger (Müll.). "*Lymnæa peregra*. Small and clear from mouth of the brook on Shore, Crosbie (Little Brighton), Sept., 1846. Upper Lake, Birkenhead Park, Aug., 1848. Pits, Edge Hill, May, 1850. Pits, Huyton, June-July, 1850."

Limnæa palustris (Müll.). "*Lymnæa palustris*. Drains on the Marsh, Hoylake, July, 1849. Ditches and drains, Southport, Sept., 1850. Blackpool, Aug., 1851. Wood Big Mains, Huyton, May-Aug., 1851. Little Crosbie, May-Aug., 1856. Semi-fossil ? from clod of turf under the sand on the shore, Hoylake, July, 1849."

Limnæa truncatula (Müll.). "*Lymnæa minuta*. Pit behind Catholic Chapel, Edge Hill, May, 1850. Ditch, Upton, June 5, 1851."

Limnæa glabra (Müll.). "*Lymnæus glaber* (*elongata*) from ditch near Brimstage, June 6-27, 1853. *Lymnæus elongata*. Ditch by road from Saughall to Woodchurch, Sept. 30, 1853."

Planorbis planorbis (L.). "*Planorbis marginatus*. Pit below the hill, Upton, July 15, 1851."

Planorbis carinatus (Müll.). "*Planorbis carinatus*. Rivulet from well near Grange-hill, Hoylake, July, 1849. Ditch near New Church, Bidston, June 2, 1851."

Planorbis albus Müll. "*Planorbis albus*. Pit near railway, Edge Hill, May, 1850. Pit, Upton, June, 1850. Pits, plentiful, Huyton, June-July, 1850. Saughall, May-August, 1856."

Planorbis crista (L.). "*Planorbis imbricatus*. Pit in plantation at Upton, June, 1850, and Sept. 30, 1853."

Planorbis vortex (L.). "*Planorbis vortex*. Pit near railway, Edge Hill, May, 1850. Semi-fossil ? from clod of turf under the sand on the shore Hoylake, July, 1849."

Planorbis spirorbis (L.). "*Planorbis spirorbis*. Pit, Upton, June, 1850. Pits, plentiful, Huyton, June-July, 1850."

Planorbis contortus (L.). "*Planorbis contortus*. Ditches and drains, Southport, Sept., 1850. Ditch, Leasowe, June 16, 1851. Hightown, May-Aug., 1856."

Segmentina nitida (Müll.). "*Planorbis nitidus*. Pit, Upton, June, 1850. Pits, roadside, Sutton, July 18, 1851."

Ancylus lacustris (L.). "*Velletia lacustris*. Pit, Huyton, June-July, 1850. Pit, 'Logwood,' Huyton, May-Aug., 1851. Pit, Upton, June, 1850."

Ancylastrum fluviatilis (Müll.). "*Ancylus fluviatilis*. Brook near the bridge, Upton, June, 1850. Torbuck Brook, Huyton,

June–July, 1850, and May–Aug., 1851. Brook, Upton, June 5, 1851. Patrick's Wood. Bromboro' Pool, between High Road and railway, May–Aug., 1856."

Physa fontinalis (L.). "*Physa fontinalis*. Pit near brickfields, Low Hill, May, 1850. Brook near the bridge, Upton, June, 1850. Pits, plentiful, Huyton, June–July, 1850. Ditch, Leasowe, June 16, 1851."

Aplexa hypnorum (L.). "*Aplexa hypnorum*. Ditches near Upper Parliament Street [Liverpool], June, 1850. Ditch, nr. Mr. Kenyon's Ground, Huyton, June–July, 1850. Ditches and drains, Southport, Sept., 1850."

Pyramidula rupestris (Drap.). "*Helix umbilicata*. Main walls from 4 to 6 feet up, Furness Abbey, July 11, 1852."

Lauria cylindracea (da Costa). "*Pupa umbilicata*. Hedge bank, Wallasea. Brickfield, Upton, June 5, 1851. Old walls, Bidston, June 16, 1851. Furness Abbey, walls from 4 to 6 ft. up."

Lauria anglica (Fér.). "*Pupa anglica*. Patrick's Wood, Bromboro' Pool, between High Road and railway, May–August, 1856."

Pupilla muscorum (L.). "*Pupa marginata*. Under stones behind the sandhills, New Brighton, June, 1850."

Columella edentula (Drap.). "*Vertigo edentula*. 'Logwood,' Huyton, May–Aug., 1851. *Pupa edentula*. Patrick's Wood, Bromboro' Pool, between the High Road and the railway, May–Aug., 1856."

Acanthinula aculeata (Müll.). "*Helix aculeata*. Amongst decayed leaves at 'Greenwood', Bebbington, June, 1850. Plentiful, 'Logwood,' Huyton, May–Aug., 1851. Patrick's Wood, Bromboro' Pool, between High Road and the railway, May–Aug., 1856."

Vallonia pulchella (Müll.). "*Helix pulchella*. Under stones behind the sandhills, New Brighton, June, 1850."

Vallonia costata (Müll.). "*Helix crenella*. Brickfield, Upton, June 5, 1851. Leasowe, June 16, 1851."

Cochlicopa lubrica (Müll.). "*Bulimus lubricus*. Under stones behind sandhills, New Brighton, June, 1850. Huyton, 1850 and 1851. Preston, Aug. 9, 1851."

Ena obscura (Müll.). "*Bulimus obscurus*. From old wall on road to Ferry-house, Parkgate, June 6–27, 1853, one specimen."

Punctum pygmæum (Drap.). "*Helix pygmæa*. Brickfields, Upton, June 5, 1851. *Helix pygmæa*? 'Logwood,' Huyton, May–Aug., 1851."

Goniodiscus rotundatus (Müll.). "*Helix rotundata*. Railway bank, Huyton, June–July, 1850. Mosley Vale, garden wall near brook, June, 1850. Old wall, plentiful, Upper Tranmere, Aug., 1850."

- Petasina fulva* (Müll.). "*Helix fulva*. In wood leading to the Hall, Speke, Aug., 1850. 'Logwood,' Dam, Huyton, May-Aug., 1851. Patrick's Wood, Bromboro' Pool, between High Road and the railway, May-Aug., 1856."
- Zonitoides excavatus* (Alder). "*Helix excavata*. In wood leading to the Hall at Speke, Aug., 1850."
- Helicella draparnaldi*, Beck. "*Helix lucida*. 'Logwood' mill-dam, Huyton, June-July, 1850, and summer, 1851."
- Helicella cellaria* (Müll.). "*Helix cellaria*. Bottom of our garden, Edge Hill, May, 1850. Quarry near Liscard, June, 1850. Halsnead Park, Huyton, June-July, 1850. Plentiful in old wall, Upper Tranmere, Aug., 1850. Preston, Aug., 1851. Furness Abbey, July 11, 1851. Patrick's Wood, Bromboro' Pool, May-Aug., 1856."
- Helicella alliaria* (Miller). "*Helix alliaria*. Under stones behind the sandhills, New Brighton, June, 1850. Huyton, June-July, 1850. Patrick's Wood, Bromboro' Pool, May-Aug., 1856."
- Helicella nitidula* (Drap.). "*Helix Nitidula*. Leasowe, June 16, 1851. Preston, Aug. 9, 1851. Patrick's Wood, Bromboro' Pool, May-Aug., 1856."
- Helicella radiatula* (Alder). "*Zonites radiatulus*. Under stones in old pasture (Nathan's Roughts), Huyton, June, 1856."
- Vitrea crystallina* (Müll.). "*Helix crystallina*. Amongst decayed leaves at 'Greenwood', Bebbington, June, 1850. Ditch side, Upton, June 5, 1851. Field near brook, Upton, July 15, 1851. 'Logwood' Dam, Huyton, May-Aug., 1851."
- Vitrina pellucida* (Müll.). "*Vitrina pellucida*. Under stones behind the sandhills, New Brighton, June, 1850. Alive, at 'Logwood', Huyton, 1851."
- Candidula caperata* (Mont.). "*Helix caperata*. On Common (Warren), Crosbie (Little Brighton), July, 1848. Under stones behind the sandhills New Brighton, June, 1850. Lane leading to Mill, Wavertree, Aug., 1850. Furness Abbey, July 11, 1851."
- Cochlicella acuta* (Müll.). "*Bulimus acutus*. Field beyond Leasowe Lighthouse, July 5, 1852."
- Ashfordia granulata* (Alder). "*Helix (sericea)*. Very plentiful, Preston, Aug. 9, 1851."
- Fruticicola subrufescens* (Miller). "*Helix fusca*. Upton, lane leading to Moreton, Sept. 27, 1852."
- Fruticicola hispida* (L.). "*Helix hispida*. Garden wall, near brook, Mosley Vale, June, 1850. Leasowe, June 16, 1851. Upton, June 5, 1851. 'Logwood' Dam, Huyton, 1851."
- "*Helix concinna*. Quarry near Liscard, June, 1850. Halsnead Park, Huyton, June-July, 1850. Preston, Aug. 9, 1851."

Fruticicola striolata (C. Pfeiffer). "*Helix rufescens*. Preston, Aug. 9, 1851. Lane from Church (Castle) to riverside, Lancaster, Aug. 5, 1852. Lane to stone quarry near Windmill beyond Wavertree, May-Aug., 1856."

Arianta arbustorum (L.). "*Helix arbustorum*. Plentiful in old wall, Upper Tranmere, Aug., 1850. Preston, a pale var., Aug. 9, 1851. Furness Abbey, small var., July 11, 1851."

Helix aspersa Müll. "*Helix aspersa*. Abundant on Commons, Hoylake, July, 1849. Higher Tranmere, May-Aug., 1856."

Helix nemoralis L. "*Helix nemoralis*. Abundant on Common (Warren), Crosbie (Little Brighton), July, 1848. Abundant on Commons, Hoylake, July, 1849. Quarry, Allerton Road, Wavertree, May, 1850. Huyton, June-July, 1850. Preston, Aug. 9, 1851."

Helix hortensis Müll. "*Helix hortensis*. Hedge bank between coal pits and Halsnead Park wall, Huyton, May-Aug., 1851."

"*Helix hortensis* ? var. Very plentiful, variety dull white, embankment of bridge over the River Alt on round from Formby to Ince, May, 1857."

Balea perversa (L.). "*Balæa perversa*. From Poplar-trees near ditch at lower end, Clifton Park, Birkenhead, June 17, 1852. Patrick's Wood, Bromboro' Pool, 1856."

Clausilia rugosa Drap. "*Clausilia rugosa*. Clay cliffs, New Ferry, June, 1850."

"*Clausilia nigricans*. Patrick's Wood, Bromboro' Pool, 1856."

Succinea putris (L.). "*Succinea amphibia*. Brook, Mosley Vale, Aug., 1850. Pit, in Mr. Kenyon's Ground, Huyton, June-July, 1850. Brook, Upton, June 5, 1851. Dam, Huyton, May-Aug., 1851."

Dreissensia polymorpha (Pallas). "*Dreissena polymorpha*. Leeds and Liverpool Canal from Kirby to Litherland, July 23, 1852. General, Mersey and Dee Canal, Mollington to Ellesmere Locks, Aug. 24, 1852. Leeds to Liverpool Canal being let dry to Linacre Bridge observed all the stonework of the sides and bridges beyond Sandhills Bridge to be completely encrusted, May 9, 1853."

Sphærium rivicola (Leach). "*Cyclas rivicola*. Leeds and Liverpool Canal from Kirby to Litherland, July 23, 1852. Leeds and Liverpool Canal, Sandhills Bridge to Linacre Bridge, May 9, 1853. Mersey and Dee Canal, Mollington to Ellesmere Locks, Aug. 24, 1852."

Sphærium corneum (L.). "*Cyclas cornea*. Pit near railway, Edge Hill, May, 1850. Pit, Upton, June, 1850. Plentiful, Huyton, 1850 and 1851."

Sphærium lacustre (Müll.). "*Cyclas calyculata*. Pit near sandy

lane, Huyton, May-Aug., 1851. Pit near Saughall, Sept. 30, 1853."

Pisidium amnicum (Müll.). "*Pisidium amnicum*. Leeds and Liverpool Canal from Kirby to Litherland, July 23, 1852. Same canal, between Sandhills Bridge and Linacre Bridge, May 9, 1853. Mersey and Dee Canal, from Mollington to Ellesmere Locks, Aug. 24, 1852."

Pisidium nitidum Jenyns. "*Pisidium nitidum*. Blackpool, Aug., 1851. *Pisidium nitida*? Stourton Hill, Aug., 1850."

Pisidium pusillulum B. B. Woodward. "*Pisidium pusillum*. Ditches near Upper Parliament Street [Liverpool], June, 1850."

Pisidium henslowanum (Sheppard). "*Pisidium Henslowanum*? near Roby, June or July, 1850."

Anodonta cygnea (L.). "*Anodonta cygneus*. Plentiful, pits, Huyton, Sept., 1849. Small Greasby brook, Sept. 30, 1853. Small, Saughall, May-Aug., 1856.

"Var. *cellensis*. Pit, Sutton, July 18, 1851.

"Var. *ponderosa*. Pit in Leg [? Ley] Brook, Upton, July 15, 1851."

Unio pictorum (L.). "*Unio Pictorum*. One specimen, small, Shropshire Canal at Chrislington [Christleton], near Chester, July, 1857."

HELIX MINUSCULA BINNEY.

By A. J. PEILE.

Read 4th April, 1936.

As this little snail, which must now be called *Hawaiiia minuscula* (Binney), occurs in the Bermuda Islands and forms part of to-day's exhibit, an account of its distribution and (consequent) vagaries in nomenclature may be of interest. The following summary only includes the first use of a new generic or specific name.

1840. *Helix minuscula* Binney. Ohio. *Boston Journ. Nat. Hist.*, iii, p. 435, pl. 12, f. 4.

1841. *Helix minutissima* Lea. Cincinnati. *Proc. Am. Phil. Soc.*, p. 82.

1849. *Helix apex* Adams. Jamaica. *Contributions to Conch.*, 3, p. 36.

1851. *Hyalina minuscula* (Binn.) Pfeiffer. *Zeitschrift*, p. 178.

1851. *Helix minutalis* Morelet. Yucatan and Cuba. *Test. Noviss.*, ii, p. 7.

1853. *Helix lavalleana* Orbigny. Cuba. *Sagra*, French ed., p. 161 t. 8, ff. 20-23.

1854. *Helix kawaiensis* Pfeiffer. Kawaii. *Proc. Zool. Soc.*, p. 52.
1855. *Helicella minuscula* (Binn.) H. & A. Adams. *Genera Moll.*, ii, p. 118.
1860. *Microphysa minuscula* (Binn.) Martens in *Albers Heliceen*, ed. 2, p. 82.
1864. *Pseudohyalina minuscula* Morse. *Journal Portland Soc. Nat. Hist.*, i, pp. 5 and 16, pl. vii, f. 35.
1870. *Helix blakeana* Tate. Nicaragua. *Am. Journal Conch.*, v, p. 155, t. 16, f. 3.
1871. *Helicopsis kauaiensis* (Pfr.) Pease. Kauai. *Proc. Zool. Soc.*, p. 475.
1872. *Zonites (Hyalinia) minusculus* (Binn.) Fischer and Crosse. Mexico. *Miss. Sc. Mex. Moll.*, p. 175.
1880. *Choanomphalus minusculus* (Binn.) Strebel. E. Mexico. *Beitr. Mex. L. & S. Conch.*, iv, p. 19, t. 4, f. 10.
1891. *Charopa unwini* (Braz.) Hedley. Lord Howe Island.¹ *Records Aust. Mus.*, i, p. 138.
1898. *Zonitoides (Pseudohyalina) minusculus* (Binn.) Pilsbry. *Nautilus*, p. 131.
1911. *Hawaiia kawaiensis* (Pfr.) Gude. Sandwich Islands. *Proc. Malac. Soc.*, ix, p. 272.
1913. *Macgillivrayella crystallina* Preston. Norfolk Island.² *Ann. & Mag. N.H.*, xii, p. 532.
1928. *Pseudovitrea minuscula* (Binn.) Baker. Michigan. *Proc. Acad. Nat. Sc. Philad.*, lxxx, p. 25.
1930. *Hawaiia minuscula* Baker. *Occ. Papers Mus. Zool. Univ. Mich.*, p. 34.

In addition to the localities given above the shell has been recorded from many North American stations and from Porto Rico, St. Thomas, Manchuria, and Japan. For references see Martens *Biologia Centrali-Americana*, L. & F.W. *Mollusca*, p. 125.

For references to occurrence in the British Isles see *Synonymy of British non-Marine Mollusca*, Kennard and Woodward, 1926, p. 354.

¹ See *Proc. Malac. Soc.*, xviii, p. 266.

² This identification, made by myself, of specimens in the British Museum, has not been previously recorded.

SIMNIA PATULA (PENNANT) IN ORKNEY.

By R. RENDALL.

(Read before the Society, 9th May, 1936.)

THE parish of Birsay lies on the north-west corner of the main island of the Orkneys. Its seaward boundary is a rampart of rocky cliffs, broken on its western coastline by two open bays, exposed to the Atlantic. The larger, whose rocky shore is a rich hunting ground for the marine zoologist, is enclosed on the south by Marwick Head, a perpendicular face of rock rising 300 feet sheer out of the sea, and on the north by the Brough of Birsay, a grassy island with high sea-cliffs, which on the landward side slope down to a rocky beach, distant from the mainland about 250 yards. At low-tide this intervening channel is laid bare, and the exposed zone provides an excellent field for the collector.

In the shallower sunny pools *Tethys punctata* is (or was) by no means uncommon. During spring-tides *Trivia monacha* may be taken alive at the extreme low-water mark. From nearby rock-pools I have collected specimens of *Archidoris britannica*, *Æolidia papillosa*, and *Berthella plumula*.

A strong tideway runs through the channel during high water, so that, especially after stormy weather, the deposits on the beach are changed with every tide. There are good shell-drifts along the tidal edges of these deposits, and although these are largely composed of rough shell-sand, there is a fair proportion of small shells, among which may be found many sub-littoral species. Indeed, I know of no other area in our Orkney group where a better collection, representative of our small and more locally distributed species, could be made. These drifts vary greatly from season to season, but the turbulence of the tides makes a prolonged dearth of good material a rare occurrence.

The characteristic shells include *Emarginula reticulata*, *Diodora apertura*, *Patelloida virginea*, *Margarites groenlandicus*, *Eulima trifasciata*, *Erato voluta*, and *Arca tetragona*, besides such commoner genera as *Patina*, *Gibbula*, *Calliostoma*, *Lacuna*, *Littorina*, *Rissoa*, *Mangelia*, *Astarte*, *Chlamys*, and *Cardium*. From similar drifts on the south side of the bay I secured the only four specimens (shells only) of *Lepeta fulva* which I have yet found in Orkney.

Last summer, in the month of August, I spent an afternoon in this district with two friends. While crossing over to the Brough at low-tide in order to visit the recently excavated ancient monastic settlement, we were attracted by some unusually rich shell deposits. After a short cursory search one of my friends, Dr. Ronald B. Mooney, handed me an unfamiliar shell with the remark: "Have you seen one like this before?" I had not. It was a specimen of

Simnia patula, a species which, so far as I can ascertain, has not hitherto been recorded from the north of Scotland, and whose only other Scottish record is from the Sound of Mull.

The British distribution of *S. patula* is given by Jeffreys (1)¹ as ranging from Sark and Guernsey to the Sound of Mull, with Dorset, Devon, Cornwall, co. Galway, Turbot Bank (co. Antrim), and Magilligan as intermediate stations. Forbes and Hanley (2) mention Birterbuy Bay and Arran in Ireland as localities in which it has been found. Its occurrence at Magilligan has recently been noted in this *Journal* (3), and its rarity in north-east Ireland commented on. From information kindly sent me by Mr. Tomlin it appears that *Simnia patula* has also been reported from Wexford and Killala in Ireland. He writes: "I looked in my volume of J. T. Marshall's bound papers which are full of MS. additions, but found no northern localities for *Simnia*; he adds Wexford and Killala in Ireland," and continues: "I have just found very fine examples of *Simnia* in Marshall's collection from Torbay. Marshall also has Scilly examples." A later record from Torbay has also been sent me by Mr. Alan P. Gardiner, who gives "*Simnia patula* (Pennant) off Thatches Rock, Torbay, *fide* Fowler."

Even though an isolated record, the occurrence of *S. patula* in Birsay confirms the significance of this district as a Scottish link with the marine fauna of western Ireland. A few years ago, in this same locality I was fortunate in obtaining a single specimen of *Physcosoma granulatum* (Leuck.) (now in the Royal Scottish Museum, Edinburgh), which had only been once reported from Scotland before. These two records linked up Ireland and Norway in its distributional range.

Dr. A. C. Stephen, to whose kindness I was indebted for the identification of this Sipunculid Worm, in his notes upon its distribution (4) remarks: "According to Southern it is the most abundant littoral Gephyrean on the West of Ireland. It has not been found in the Irish Sea. North of Ireland it seems relatively scarce, since it has only been recorded twice from Scotland and twice from Norway." The British distribution of *S. patula*, which has several stations on the West of Ireland, none in the Irish Sea, and only two from Scotland (one from the West and one from Orkney) provides an interesting parallel.

The southern element in the Birsay marine fauna is further illustrated by the striking similarity between the types found in the shell-list for the west of Orkney and those recorded for Magilligan by Miss Nora Fisher. Of the 162 species in the Irish list 111 are found on the west coasts of Orkney (Birsay and Hoy Sound), and

¹ The numbers in parentheses refer to Bibliography at end of article.

of the remaining fifty-one only twenty-six are unrepresented by other species of the same genera, and several of the fifty-one are to be found on other Orkney shores. I am indebted to Mr. R. Winckworth for the list of mollusca dredged by him in Hoy Sound in 1916, which supplemented considerably the results of my own shore collecting.

The Orkney Islands as a group are uniquely situated from a marine-zoological point of view. They not only represent the northerly fringe of our western marine fauna, but they are also within the range of our Arctic species. Hugh Miller (5) remarks upon the pronounced difference between the sea-life of the western and eastern shores of Scotland. Orkney, geographically placed beyond the conjunction of both coastlines, has links with the distinctive features of each. A complete faunistic survey of Orcadian marine forms yet remains to be undertaken, and its results co-ordinated with the faunas of other areas. Deep-sea dredging would secure a wealth of interesting material. Jeffreys's Report (6) on his Shetland dredgings (1861-8) indicates the advancement in knowledge of new forms, and in the distribution of old, which such work makes possible.

The possibility of this single specimen of *S. patula* having been carried northward by tidal action must not be overlooked. Tropical seeds are found not infrequently along the western coasts of Orkney. Even from as far north as the Faroes, exotic molluscan forms have been reported by accurate observers (Jeffreys's Report for 1868).

In Jeffreys's distributional notes on *S. patula* (1) the Coralline zone is given as its usual habitat. Records recently published by the Marine Biological Association (7) gives its bathymetrical range as being from 10-49 fms., which confirms the dredging experience of Forbes and McAndrew (2), who took it alive "in the crevices of *Alcyonium* off the Land's End in twenty fathoms". Various grounds in Plymouth waters are recorded, and the association of the mollusc with *Eunicella* and *Alcyonium digitatum* noted.

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- (7) *Plymouth Marine Fauna*, 2nd Ed., 1930, Marine Biol. Assoc.

EDITORIAL NOTES.

It is with great regret that we have to chronicle the three following deaths : that of James A. Grieg, the well-known curator of the Bergen Museum in Norway ; that of Leopoldo Faustino, of the Manila Bureau of Science ; and that of Robert J. Welch, of Belfast, who has been a member of the Society for more than forty years. We hope to publish some account of Welch's life in our next number.

Mr. C. H. Moore has been continuing his excellent work on the Society's collections at Manchester during the past twelve months—boxing, arranging, and cataloguing. He has been devoting most attention to the J. W. Taylor collection, both land and freshwater shells.

To show the extent of this collection we select quite at random from Mr. Moore's catalogue a few examples of the number of exponent series : *Arianta arbustorum* is represented by 63 sets, *Cochlicella barbara* by 30, *H. pisana* by 40, *Balea perversa* by 18, *Carychium minimum* by 20, and *Lymnæa peregra* by 82.

The J. W. Jackson Collection of British Mollusca has recently been acquired by the Public Museums, Liverpool. It includes the Robert Standen Collection and also many specimens collected by older workers, forming altogether a representative series of British marine shells and a fine assemblage of locality sets in the land and freshwater portion. Of the latter material a good deal comes from localities that have since been built over or otherwise destroyed, mainly in Lancashire and Cheshire. A series of Crag shells named by Alfred Bell is also included as well as shell-marl material and shells from other British Post-tertiary deposits.

Mr. Lloyd James mentions in lit. that he took a scalariform *C. nemoralis* last July at Middle Barton, Oxon, yellow with band formula 00345.

We have recently received from Mr. Sohtsu G. King two interesting pamphlets ; one is a catalogue of his conchological library, which he has this year presented to The Science Society of China Library at Shanghai. It is an extremely valuable collection, including such things as the *Thesaurus*, *Conchologia Iconica*, *Manual of Conchology* (both series), and most of the serials which deal with mollusca complete.

The other pamphlet, by Grabau and King, is the second of the educational handbooks published by the Peking Society of Natural History, and entitled the *Shells of Peitaiho*. Written in a popular style and illustrated with numerous woodcuts, this excellent brochure starts with notes on collecting and cleaning shells, and on the characters and terminology of the molluscan shell. The rest is devoted to the commoner shells of the Peitaiho beaches.

The first mollusca part has just been published of the *Fauna van Netherland*, dealing with the Opisthobranchs, Amphineura and Scaphopods, and written by Miss Tera van B. Jutting and Dr. Engel.

This strikes us as a particularly well got up little handbook, excellently printed, with plenty of good text-figures : each nudibranch genus is illustrated by a figure—usually photographed from Alder & Hancock's monograph. There are also many drawings of radulæ and other details, especially in the Amphineura. Similar handbooks are much to be desired dealing with our British marine Mollusca.

E. E. Andrews, of Johns Hopkins University, has a very interesting account in the *Nautilus*, vol. 49, p. 2, 1935, of the rapid growth of a variety of the common Jamaica *Pleurodonte acuta* (Müller) which he reared from the egg. Of two born on 9th August, 1932, one measured 7×6.5 mm., and this seems to have been the average size at birth. On 3rd September one specimen had a diameter of 17 mm. The rate of growth in either case was 10 mm. per month at first, but this did not continue, and it was found that the smaller example took till January to attain the size reached by the larger in October. In November the larger was forming its peristome, so that under the conditions of feeding in confinement this fine snail may attain maturity in about four months.

In the *Nautilus* for last July H. E. J. Biggs has a first-rate article on shell-collecting on the Iranian plateau. He gives a very terse and vivid little pen-picture of the sort of country it is and of the possibilities of collecting, as well as notes on the mollusca collected. Altogether it is a most readable paper, and we are glad to know that our member is going to give this journal some fuller account of his Persian collecting before long.

We have received *Fossils*, by Professor R. S. Lull, director of the Peabody Museum at Yale University, one of the University Series published by the University Society of New York (Chapman & Hall, Ltd., price 4s. 6d.).

The object of this series is stated to be to present concisely and attractively the story of the life of mankind. The fossils treated of in this volume are mainly vertebrates, and there are some interesting figures of prehistoric creatures restored. Perhaps the most interesting chapter is that on Fossil Men, with six figures of the chief forms so far discovered. As far as it goes the book contains a lot of interesting matter and good figures, but with so comprehensive a title one would have expected more details about invertebrates; it would almost be possible to go through the book without realizing the existence of such a thing as a fossil mollusk. There is certainly no figure of one.

The book is evidently based on the magnificent collection of fossil vertebrates assembled by Marsh at Yale.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND

634th Meeting (Joint Meeting with the Yorkshire Conchological Society),
held at the Manchester Museum, 4th April, 1936.

The President, Lieut.-Col. A. J. Peile, in the chair.

Present : Messrs. H. Emmett, J. H. Goodson, A. V. Wild, J. C. North,
F. Taylor, E. Dearing, S. W. Brooks, Mr. and Mrs. G. C. Spence, Mr. and
Mrs. C. H. Moore, Dr. and Mrs. Wilfrid Jackson, Miss Jackson, and
Mrs. Morehouse.

Election of New Member.

Wilfrid Edward Reeve.

The President read a short paper entitled "Some Tristram Types".
He also exhibited a series of land shells found in Bermuda but of exotic
origin and gave a short account of the conditions affecting their introduction.
He commented on the extended wanderings of *Helix minuscula* Binney
and the involved synonymy pertaining to this snail.

Exhibits.

By Mr. C. H. Moore : Series of *Haliotis*, *Nassarius*, and *Ancilla*.

By Mr. F. Taylor : *Planorbis dilatatus*, *Physa heterostropha*, and *Bithynia
tentaculata*, from hot-water reservoirs at Royton, near Oldham, Lancashire,
collected 18th March, 1936 ; series of *Lymnæa glabra* and *L. truncatula*,
from Chadderton, near Oldham ; series of *Helix hortensis*, from Carshalton,
Surrey ; and series illustrating Dimorphism in *Zonitoides*.

By Mr. G. C. Spence : *Diplommatina* and *Alycæus*.

By Mrs. Morehouse : *Helicostyla*, *Rhysota*, *Obba*, *Eulota*, *Geophorus*,
and *Cyclophorus*, from Isle of Cebu, Philippines ; also on behalf of
Miss K. M. Morehouse, *Patella vulgata* and *Nucella lapillus*, from Ravenscar,
Yorks, and a red variety of *Littorina littorea*, from Robin Hood's Bay, Yorks.

By Messrs. H. Emmett and J. H. Goodson : Shells from localities in
North Staffordshire ; also *Helix terrestris* and var. *grisea* from Dover.

By Dr. J. W. Jackson : Scalariform examples of *Achatina fulica* Fér.;
also a reversed specimen ; scalariform specimen of *Achatina panthera* Sw.,
and a dwarf specimen of *Cypræa tigris* L., 54 by 39 mm.

635th Meeting, held at the Manchester Museum, 9th May, 1936.

Mr. G. C. Spence in the chair.

Member Deceased.

G. H. Weaver

Member Resigned.

J. Newton.

Papers Read.

"*Simnia patula* (Penn.) in Orkney," by Robert Rendall.

"New *Clausilia* from Asia Minor," by H. E. J. Biggs.

Exhibits.

By Mr. A. K. Lawson : *Ena obscura*, *Clausilia laminata*, *C. bidentata*,
and *Succinea putris*, from Weaver Valley, Cheshire ; *Lymnæa glabra*, from
pond at Didsbury, Lancs.

By Mr. G. C. Spence : Series of *Ennea*.

By Mr. C. H. Moore : *Amphiperas* and *Birostra*.

There was no meeting in September.

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CONTENTS.

	PAGE
List of Officers and Council	289
Changes of Address	290
<i>Anodonta</i> in E. Kent—J. E. COOPER	290
<i>H. jenkinsi</i> on Beachy Head—G. SHRUBSOLE	290
Obituary Notice: Harry Sowden—Dr. GAYNER	291
Some Radula Problems, with text-figures (Presidential Address)—A. J. PEILE	292
Dredging in Loch Linnhe—W. FOWLER	305
Accounts	306
Mollusca of the Sheep Ponds on the Eastbourne Downs— G. SHRUBSOLE	308
Proceedings: 10th Oct. (Annual Meeting), 14th Nov., 12th Dec., 1936; 9th Jan., 1937	310
Editorial Notes	319

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Anodonta in East Kent.—The doubtful occurrence of *Anodonta cygnea* in Chislet Marshes was mentioned in Vol. XIX, p. 321. It is now possible to supplement that note. During the years 1934–5 the two main drainage ditches in these marshes were dredged with a power-driven "grab". This scooped up large quantities of clay and mud. Both *Anodonta cygnea* and *A. anatina* were found sparingly in clean fresh condition (though not actually alive) in "spoil" from the Whitfield Sewer. The mud of the North Stream yielded hundreds of both species, all dead, and mostly discoloured. What killed all these mussels? A possible explanation is that it was due to tarry surface-water from the main road, which crosses the head of the North Stream, and from a by-road which runs parallel to it. The main road was heavily tarred some five or six years ago. *A. cygnea* is supposed to live in the River Stour, but careful search in dredgings from that river near Sturry last year failed to produce a fragment. When the southern part of the Whitfield Sewer was dredged in 1934 the grab brought up quantities of *Cardium edule*, which lived there when the Wantsum was a sea. The locality is now 2 miles from the coast.—J. E. COOPER.

Hydrobia jenkinsi on Beachy Head.—In the field adjoining the higher of the two ponds on the road up to Beachy Head is a large cement drinking trough, 36 by 4 by 3 feet. In March, 1936 it was seen to contain *H. jenkinsi* in considerable numbers. The trough probably gets its water from the pond 100 yards distant. Both pond and trough have been under observation for nearly three years. The pond was cleaned in 1933 and no snails could be found in it till October, 1934. It now holds *L. peregra* and *S. lacustre*, the former abundantly. Both are found in the trough. *H. jenkinsi* has never been taken in the pond. The only pond on these Downs holding *H. jenkinsi* is Friston, 3 miles away, where it was introduced ten years ago, probably with marsh water. Some ten ponds lie between Friston and the trough, and in none of these is it found. The pond and trough are situated (470 feet) almost at the end of the Downs at Beachy Head, the ground falling rapidly to the sea. Excepting Friston the nearest localities for *H. jenkinsi* are the Cuckmore Valley, over 6 miles away, and the marshes beyond Eastbourne, over 3 miles distant.—G. SHRUBSOLE. (*Read before the Society, 10th October, 1936.*)

OBITUARY NOTICE : HARRY SOWDEN.

By Dr. J. S. GAYNER.

(Read before the Society, 12th December, 1936.)

BORN at Meanwood, Leeds, on 28th June, 1870, he went to work at the Heath Nurseries, Moortown, Leeds, on leaving school, and from there as under-gardener to Carr Manor, Meanwood, then the home of Dr. Clifford Allbutt. Later he moved to York, where he came under the influence of John Hawkins, a member of the York City Police and an excellent naturalist. Hawkins led him into both ranks; for Sowden joined the City Police in 1891 and the York and District Field Naturalists' Society in 1902. Like so many hundreds more it was as a collector of butterflies and moths that Sowden commenced as a naturalist; but, turning to conchology, he built up a magnificent collection of the British Non-marine Mollusca. He became Recorder for Conchology to the York and District Field Naturalists' Society in 1916 and discharged this duty till his death, with the special care to record the work of others. In 1917 Sowden joined the Conchological Society of Great Britain and Ireland, and in November, 1925, the Yorkshire Conchological Society, becoming its President in 1928. The Report of the Yorkshire Philosophical Society for 1929 records Sowden's appointment as honorary Curator for Conchology to the Society.

Sowden's own additions to the recorded molluscan fauna of this district were : —

- 1896. *Arianta arbustorum*, var. *baylei*, Bishopthorpe.
- 1898. *Arianta arbustorum*, var. *hypnicola*, Bishopthorpe.
- 1910. *Helix aspersa*, var. *exalbida*, Heslington Road.
- 1917. *Vallonia costata*, by the Multangular Tower.
- 1919. *Testacella scutulum*, in Canon Watson's garden.

The following papers were published by Sowden : " Abnormal Land and Freshwater Shells " (*Journ. of Conch.*, Vol. XIX, July, 1931, pp. 142-4, and plate iv); and " The Mollusca of the Pocklington Canal, near York " (*North-Western Naturalist*, December, 1935, pp. 332-4).

He was indefatigable as a teacher, recommending books, apparatus and giving specimens or material to encourage beginners. Of the many appreciations which have reached me since his death perhaps the best was the retort to the lament : " He has taken much knowledge with him "—" He has left some with me."

SOME RADULA PROBLEMS.

By A. J. PEILE.

(Presidential Address delivered at the Annual Meeting, 10th October, 1936.)

THREE of my predecessors in office have taken radulæ as the subject of their presidential address.

In 1914 Professor H. M. Gwatkin spoke on "Some Molluscan Radulæ", describing the forms found in the Pulmonata with a special discourse on those of the Ancyliidæ.

In 1920 Dr. A. H. Cooke discussed "Evolution in the Molluscan Radula."

In 1932 Dr. E. W. Bowell spoke on "Radulæ" with special reference to preparing them for scientific examination and touching on their use in classification.

I cannot hope to compete with such authorities on their own ground. Still, regarding the radula as a piece of apparatus, I venture to submit a few of the ideas which have occurred to one whose training has been more in mechanical than biological subjects. I hope particularly that my speculations will provoke criticism and stimulate research.

What's in a name? The word Radula, meaning a scraper, may be quite a good name for the apparatus used by certain browsing snails, but as we shall see, it is questionable whether it is equally suitable for the corresponding organ in many other molluscs. Perhaps because the name suggests the function we find in literature general statements such as the following :—

"The function of the radula is to tear or scratch, not to bite; the food passes over it and is carded small" (Cooke, 1895).

The same author, however, in 1921, after speculating on the evolution of the radula, leads us on a broader if not less rocky path towards a wider view. In the final paragraph of his presidential address to this Society he says :—

"If the conditions of life, the habits, not at one stage of life only, and the food staples of the mollusca are more carefully studied, valuable information bearing on the development and modification of the radula cannot fail to be acquired."

Vice versa, if we study the radulæ of species whose feeding habits are known we shall be better qualified to envisage the possible functions of the radulæ in other cases.

Perhaps the most obvious cases of the use of a scraper are to be found among the herbivorous Pulmonates, both land and fresh-water, whose radula consists of a large number of small teeth generally more or less pointed and often furnished with cusps, used

in conjunction with a jaw in the roof of the buccal opening. Observation of the forward and upward movement of the front of the radula of a snail can be easily made. Examination of a radula will show that the foremost rows of teeth are distinctly worn, particularly the marginals.¹ But I would suggest that there is no evidence to be got from the radulæ regarding any further "carding" of the food stuff. The middle rows of the radula would appear to function merely as a carrier belt to convey the food to the œsophagus, while the hindmost rows are in reserve.

Gwatkin divides the arboreal snails into two groups. In the first the teeth have somewhat similar broad cutting edges, though they belong to families which are separated both systematically and geographically. *Amphidromus*, *Drymaeus*, etc.

In the second the teeth are clove-shaped with denticles like the fingers of a half-closed human hand. *Achatinella*, etc., in the Pacific region.

In both cases the teeth denote adaptation to special uses, and it may be significant that the marginal teeth of some of the *Succineidæ* resemble those of *Achatinella*, as evidence not of relationship but of use for a similar purpose.

I venture to suggest that the broad teeth of the first group are used for biting green leaves or mosses, while those of the second are more suited to deal with secondary vegetation such as lichens and moulds.

It is to be hoped that some day we shall get an account of the habits of *Brachypodella*, which will help to explain the use of its highly specialized and very peculiar radula (Crosse and Fischer).

The radula of many slugs and snails is composed of elements which in the centre lines resemble those of the herbivorous species, while the marginal teeth tend to resemble somewhat the teeth of the carnivores. The jaw in such species is reduced to a minimum. Many of the species so equipped avoid green food and eat lichens and fungi, and some of them are omnivorous, including animal matter in their diet. But we must not jump to conclusions. In our own fauna *Arion hortensis*, *Milax sowerbyi* and *Agriolimax agrestis*, which have similar aculeate marginal teeth to those of the other species in their respective families, are, nevertheless, guilty of attacks on garden produce. In radulæ of this type the front rows of marginals will be found to have been subjected to most wear.

¹ In the following accounts the word "wear" implies damage such as obliteration of cones and cusps. "Use" implies slight blunting of the tips of teeth or of minor cusps. We must not overlook the possibility that the radula under examination is from an animal that has just shed its worn teeth.

In *Daudebardia* and the *Oleacinidæ* the teeth are so highly specialized for carnivorous diet as to resemble those of the *Agnatha*.

In the highly specialized *Testacella*, the use of the barbed teeth for the capture of earthworms is well known. There appears to be no question of chopping up the prey which is swallowed whole and at considerable leisure.

The Agnathous land carnivores have radulæ furnished with large aculeate teeth without cusps. Where the teeth differ in size they increase from the centre line outwards. The largest teeth are sometimes half-way towards the margin and sometimes as in the highly specialized *Natalina caffra*, which has only five laterals on each side, the outermost is the largest. In this species there are also some minute marginals on each side of the radula, which may be vestigial—their possible use is obscure.

The large aculeate teeth are excellently suited for tearing the flesh from the prey and one often finds an area of battered teeth in the front part of the radula, suggesting contact with hard substances such as shell or perhaps bone in the case of species that may feed on carrion. I am convinced that, as in the case of other carnivorous animals, there is no need for mastication, and that the pieces torn off by the foremost teeth are swallowed forthwith. I have actually found in the body of *Schizoglossa* from New Zealand the undamaged radula of an Endodont snail, identified as a *Phenacohelix* and now in my collection of radulæ. I suggest that the method of swallowing is similar to that employed by snakes, the teeth on the two sides of the radula working alternately, one side pulling and the other holding.

As regards the Opisthobranchs I have little evidence to offer. The many different forms found in the Nudibranchs indicate adaptation for special purposes. See Alder and Hancock for accounts of habits, food and radulae and Sars for figures of radulæ.

For *Aplysia* we have an account by Eales : " Seaweeds are grasped by the lips and jaws and particles are scraped off by the radula. The food is then stored up in the crop ; it is finally dealt with by teeth in the gizzard to which it passes in small quantities at a time."

In the extracted radula we find that many of the smaller cusps are obliterated in the front rows.

In genera such as *Tricla*, where the animals possess powerful gizzard plates, it is probable that the strong curved lateral teeth of the radula are used as pincers for capturing the prey, which is swallowed whole.

In the *Scaphopoda* the form of the radula suggests that it is used like a nut-cracker for breaking up the shells of crustacea or small bivalves.

In certain marine families on another branch of the molluscan tree, evidence for scraping action is well documented for *Patella* and *Haliotis*.

Davis and Fleure observe that—

“ *Patella* feeds in two ways :

“ 1. By scraping algæ from rock surfaces, the radula being moved from behind forwards.

“ 2. By gripping pieces of weed with the outer lips, aided by the dorsal palate and then scraping off fragments by rasping.

“ While the tip of the radula is scraping food from the rock, another part is working against the jaw or palatal plate and thus grinding the food already obtained. This working continues after feeding has ceased and the œsophageal pouches retain the food till this is completed, when the food is passed to the crop.”

We have evidence of the scraping and carding but these actions are performed by the front of the radula only.

Examination of the extracted radulæ does not as a rule reveal signs of much wear in the front rows of teeth, which, though large are very susceptible to damage when handling the radula. This is probably because worn teeth are quickly discarded after use. There is ample provision for replacement in the very long radula. Mr. R. Winckworth has exhibited a radula of *Cellana testudinaria*, from Port Blair, 31.5 cm. in length.

Haliotis is described by Coates as “ feeding on minute encrusting algæ and fragments and surfaces of larger sea weeds scraped off by the radula which has strong lateral teeth for rasping. The numerous marginals are obviously too delicate to tear. The food is scraped by the harrow-shaped laterals and to a less extent by the gouge-shaped central. A chewing action of the radula against the jaws probably continues after the rasping has stopped. The marginal teeth probably serve as cogs to help food fragments along and aid the jaws in providing a non-skid surface to ensure the passage of food. In addition they act as combs to prevent entrance of large fragments. This is necessary because there is no triturating apparatus in the remainder of the digestive system.” In the extracted radula the big laterals are blunted in the foremost rows.

The *Fissurellidæ* probably follow the method of *Haliotis* and the evidence of the radula is the same. In the *Trochidæ* and *Turbinidæ* one will expect to find differences in the functions of the radula according to the presence or absence of jaws. *Umbonium* is worthy of special mention. It lives in sand where possibility of scraping is most unlikely. Examination of the radula shows that though the inner teeth are almost obsolete, the inner marginals are comparatively

large. I have no doubt they are used to sweep food particles into the radula. In the *Neritidæ* and *Helicinidæ* the large capituliform teeth are well suited for cutting or scraping the food, they generally show signs of use in the front rows of the radula. The centrals are degenerate, but are probably efficient as food conveyers.

It may be of some significance that in the *Rhipidoglossa* we usually find some rows of marginals in advance of the foremost inner teeth. I would suggest that the marginals, in addition to preventing the entrance of large particles, may serve, like the whalebone in Cetacea, to retain small particles while permitting the escape of water. Note the mention by Gwatkin of the "whirlpool motion" observed in the radula of *Margarites helycinus*.

Passing to the *Tænioglossa*, one of the first problems that provokes the inquiring mind is how a radula can be employed by a sessile animal like *Crepidula* or an immobile creature like *Vermetus*. This problem is satisfactorily solved by Orton (1912), whose account may be thus shortly paraphrased: "In *Crepidula fornicata* the radula is used for grasping, not rasping. A current set up by the gills causes food to collect in a food pouch in front of the mouth. The radula is shot out with marginals spread apart; these close in on the food mass and the radula is retracted, the action being repeated until a length of food mass is detached. The detached piece is then swallowed. The mandibles which are very weak and lie in the dorsal surface of the buccal cavity help in retaining the food in the pharynx. *Calyptæa chinensis* feeds in exactly the same way. *Capulus ungaricus* has no food pouch but the lips have become elongated in the form of a grooved proboscis which appears to collect food from the tips of the gills."

Pelseneer credits *Vermetus gigas* with secreting a slimy "voile" to capture small organisms, the whole being then absorbed. He also refers to the demonstration of a ciliary action in *V. novæ hollandiæ*.

In the light of the above information, let us examine the radulæ.

In *Crepidula fornicata* and *Calyptæa chinensis* the inner teeth show practically no signs of wear, the marginals in the front rows are slightly blunted.

In *Capulus ungaricus* the teeth are slightly blunted in a few of the front rows.

In *Amalthea australis*, also sessile, usually on the shells of other molluscs, the teeth are furnished with an elaborate assortment of cusps none of which show any signs of use; well-developed, oval jaws with fringed edges are present.

In *Vermetus*, which has somewhat similar jaws, the teeth show but slight signs of use in the front of the radula. In all the above, therefore, we may sum up the function of the radula as grasping,

not rasping. Swallowing naturally results, as usual in mollusca, from the chain saw motion of the backward pointing teeth. Further, it would appear that the better developed the jaws the less wear on the radula.

In *Strombus* and its allies, including *Terebellum*, on examining the dead animal we find the radula and a pair of oval jaws at the anterior end of a long snout well in advance of the tentacles and eye-stalks. The whole arrangement would appear suitable for rooting in the sand on which these animals live, though Woodward makes the statement that they are carrion feeders. Examination of the mouth parts suggests that they function like those of *Crepidula*. A bolus of gritty matter is found between the jaws and the radula, while the latter is filled with a column of the same substance which continues into the œsophagus. There is no sign of trituration by the radula, which is evidently acting as a conveyer belt. The only sign of use in the smaller species is a slight blunting of the centre cusp of the rhachidian. The small denticles, even those on the marginals, appear unaffected, and this in spite of the rough nature of the material ingested.

The radula of *S. galeatus*, which by virtue of its larger size may be assumed to deal with still coarser material, shows considerable wear of all the teeth in some of the front rows.

The *Cypræidæ* would probably provide the subject for a special study. In the absence of jaws we should expect some wear in the radula, and the amount of it would depend on the nature of the food. Taking two species at random, in *C. turdus* the front nine or ten rows are blunted, while in *C. tigris* even the front two rows are little damaged. These radulæ are generally rather long.

In *Trivia*, a genus with moderately developed oval jaws, the radula is not worn in *T. monacha*. That of *T. arctica* shows a little wear in the two front rows.

Passing to those *Tænioglossa* with large serrated jaws we find no wear in *Cymatium tranquebaricum* or in *Cassis achatina*, though the teeth of the latter, particularly the admedians, are elaborately cusped.

In *Galeodea rugosa* the radula is worn in the front rows. Surely here we have an interesting field for observation of food and habits.

For the *Tænioglossa* of freshwater Prashad gives an illuminating account of the feeding habits of *Pila*. These animals have a pair of almost circular jaws, of which the opposed edges are irregularly and bluntly serrate. He says :—

“ The chain-saw movements of the radula are very limited. The jaws, by downward and backward movements, cut up the leaves of aquatic plants. The *flattened* radula is brought to the mouth opening with cusps of the teeth pointing forwards and outwards and, by

forward and backward movements, pulls the food backwards into the buccal cavity. The radula does not seem to perform any rasping function."

I have examined the radulæ of species taken at random and found no signs of wear in *Pila dalyi*, *Turbinicola saxea*, *Saulea vitrea*, and *Pomacea peristomata*. In a radula of *Lanistes olivaceus* some of the front admedians are a little worn. This suggests similar habits in the whole of the group.

In the following British species, taken at random, the radulæ show no wear. *Viviparus fasciatus*, *V. viviparus*, and *Bithynia tentaculata*.

In the *Cyclophoridæ*, land herbivores, with large serrate jaws, the radulæ of several species, taken at random, show no signs of wear, even in the front of the radula.

In the land families *Pomatiidæ* and *Chondropomidæ*, which have no jaws, the outer marginals, which are very broad, are often advanced a few rows in front of the inner marginals with the central and admedians a little farther back. I would suggest a possibility that the advanced broad marginals may assist in collecting food within reach of the inner teeth which then convey the food to the œsophagus. The teeth never show any signs of wear so it is unlikely that they perform any abrasive duty.

The *Littorinidæ*, in which the jaws are undeveloped, would seem to browse on vegetable growths. The radula is subjected, therefore, to a degree of wear depending on the surface attacked, and it is interesting to note that in such species as *L. scabra*, which are found on mangrove-trees, the radula, though long enough to make ample provision for replacement, is far and away surpassed in length by that of such species as *L. ziczac*, which frequent hard limestone rock. I have a Bermuda specimen of the latter species, in which an animal with a shell of altitude 20.3 mm. possessed a radula 167 mm. long.

The *Naticidæ* are perhaps the most puzzling group to understand. They are possessed of well-developed, serrated jaws, yet the radulæ generally show signs of hard work in the foremost rows. It has been claimed by some authors that these animals perforate the shells of bivalves, and Jeffreys says that *N. alderi* has been observed boring in captivity. But the form of the radula seems to preclude its use for such a purpose, at any rate if we compare it with those of such *Rhachiglossa* as are well known to be borers. Schiemenz (quoted by Fischer) imputes perforation to acid secreted by an organ below and behind the mouth, which he calls *bohrdrüse*. He says that a regular cavity is bored by the acid and the bottom of the cavity is then pierced by the radula. Pelseneer (1935, p. 104) advances the

opinion that *Natica* asphyxiates the bivalve by holding it in a fold of its foot or, with *Mya*, by closing the syphons. In such cases, once the food has been broken up by the front rows of teeth there does not seem any reason for any action by the rest of the radula except as a carrier belt, and the wear which undoubtedly occurs is unexplained.

The *Rhachiglossa*, all carnivores, have radulæ variously modified, generally with three lines of teeth. In *Marginella* and some of the *Volutidæ*, laterals are not present.

In the first place we have the borers such as *Ocenebra*, *Urosalpinx*, and *Nucella*. The method of boring into shells by a rotary motion of the projecting part of the radula has been well established. See Fischer and Orton (1927). The radula suffers accordingly and will be found to have lost most of its cusps in the front portion ; some of the teeth are often worn quite smooth.

The *Nassariidæ* are credited with boring, though the teeth do not appear particularly suited to the purpose. Certainly, in many species the front teeth are chipped and battered but not worn smooth as in *Ocenebra*. Considerable variation in the form of the laterals is found in this family (Peile, 1936), and it is curious that in *N. kraussianus*, in which the smaller cone of the lateral has a row of inward-pointing denticles, it is this part of the lateral which shares the wear with the central, while the longer outer cone is comparatively uninjured so that it is still available to assist in hauling. I have noticed similar cases in other genera whose laterals have two cones, for instance in *Busycon*. In *Vasum*, on the other hand, the whole lateral may be found blunted. Some species of *Leiodomus*, allied to *Nassarius*, are certainly carrion feeders. I have seen the sand at Port Elizabeth swarming with *L. rhodostoma* advancing on dead horses lying near high water mark.

The habits of *Buccinum* are described by Dakin. It is omnivorous and dead (but fresh) and living organisms are equally acceptable. It is capable of piercing the carapace of crabs or the skin of fish caught in nets ; the radula teeth are not worn down as against a hard substance, but broken irregularly.

Babylonia, which to my recollection is a carrion feeder, has very large cones on both central and laterals, which show no signs of wear in three out of four examples examined, suggesting that their use is to tear off and shovel in masses of soft food. When wear occurs it is to the central and inner side of the lateral.

The *Mitridæ* present us with a few problems. First the occurrence in the two subfamilies of two very different types of radula : in the *Mitrinæ* it is usually very broad, with lozenge-shaped central and comb-like laterals, the latter adnate to the supporting membrane ;

in the *Vexillinæ* we find an arcuate multicuspid central (tricuspid in *Pusia*) and curved aculeate laterals which can be folded over the central. For figures of various forms of radulæ see Cooke, 1920, and Peile.

Examination of the radulæ of many species of *Mitrinæ* detects in many cases no sign of wear. When wear does occur it is on the front few rows of centrals and the inner ends of the adjoining laterals. So it is clear that the whole is not used as a rasp.

The likeness of the laterals in *Vexillinæ* to those in genera like *Murex* has suggested a similarity in habits. Examination of the radula does not support this view. I have found no signs of wear on the cusps of the centrals of *Vexillum* and *Pusia*, but a few front lines of laterals are generally wanting. This suggests that these radulæ may function like those of some of the *Tænioglossa*.

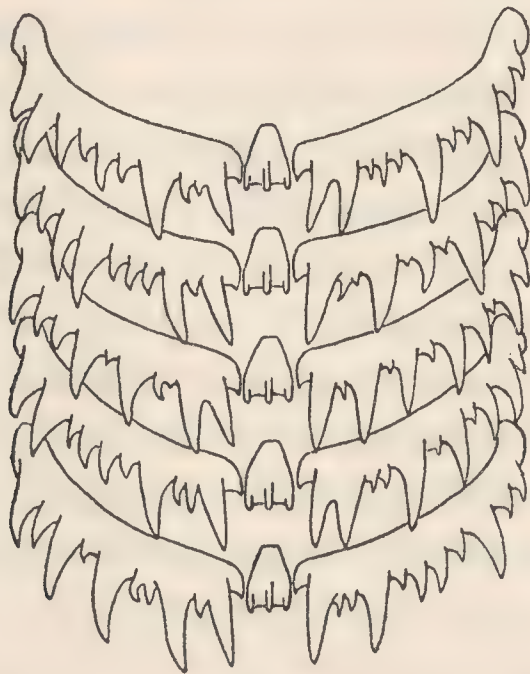


FIG. 1.—*Peristernia leucothea* Melv. Port Shepstone.
5 rows from radula. $\times 200$.

This is not all. Certain species, e.g. *Cancilla circula*, have radulæ with a central very like that of *Vexillum*, while the laterals are appressed combs similar to those of *Mitra* s.s. Altogether considerable variety in habits is suggested for the family.

The radula of *Peristernia* calls for remark. It has a family resemblance to that of *Fasciolaria*, but the laterals are much shorter combs with fewer teeth. The outstanding peculiarity of the genus is that in all the species of which the radula is known the laterals are not only asymmetrical to one another but the larger cusps and intermediate denticles that arm them do not follow the same sequence in either line, nor does the sequence appear to follow any law, except that the total number of cusps plus denticles seems pretty constant. The specimen figured has ten on one side and eleven on the other (Fig. 1). The result is that the two laterals together form

a rasp irregularly studded with cusps and denticles. The whole arrangement points to some peculiarity in habits which remains to be investigated. In a radula of *P. leucothea*, having 196 rows of teeth, we find the laterals of the front twenty-one rows worn quite smooth (parts of them in lines 15, 16, and 19 obliterated) the following fifteen rows in succession showing less and less wear. The bluntly tricuspid centrals which lie in a lower plane are practically unworn.

The radula of the *Pyrenidæ* is peculiar in having an obsolescent (?) central with no cusps and it is very long, which generally suggests provision to replace wear. In specimens examined I have not seen any signs of wear even on the small stout bilobed laterals. The fact remarked on by Cooke that the same form of radula is found throughout the whole family points not only to its antiquity but to a similarity in habits in all existing species.

The *Toxoglossa* have an apparatus for which the name radula is quite inappropriate.

For a general account of the anatomy of *Conus* see Shaw. The animal has a rostrum provided with sense organs, through which a muscular proboscis can be protruded. The teeth lie in an elbowed sac on the right-hand side of the body, formed up in two lines (formula 1.0.1). The teeth that are ready for action point towards an opening into the œsophagus, while the remainder, with the nascent teeth, point in the other direction in the hinder arm of the sac. For guidance as to further details I am indebted to Dr. L. C. D. Hermitte, who is at present engaged in a thorough investigation of this group of animals, following on the severe muscular paresis of a patient who was stung by *C. geographus*. For other records of stings see Iredale. The hollow teeth are composed of a rolled up plate, as pointed out by Troschel; the barbs and serrations, when present, are formed by indentations on the sides of the plate, verified by myself recently for teeth of *C. miles* and *C. zonatus*. To prepare for action, one tooth is detached from the bunch, enters the pharynx and is held, projecting, in the end of the proboscis. I have seen this myself in dead specimens of *C. striatus*, *C. terebra*, and *C. geographus*. It is probable that this result is attained by the complete invagination of the proboscis, which then seizes a tooth by the barbed end. The proboscis when everted would hold the tooth in the required position.

A hollow muscular bulb (called by previous authors the poison gland) is connected to an opening in the pharynx by a very long convoluted tube (called previously the poison duct), the highly specialized epithelium of which, in Hermitte's opinion, actually secretes the poison. At the moment of attack, by contraction of the bulb, poison is driven through the proboscis into the tooth, which

enters the prey and probably remains there by virtue of its barbs. Pelseneer says that *Conus* feeds principally on annelids. It seems to me as not too fanciful to suppose that the worm is immobilized by a tooth shot like an arrow into its burrow or other habitation from which it is then extracted by the proboscis of the cone.

Many forms of teeth are found, and some are figured by Troschel and by Thiele. Some of them have a projection on the base of the shaft which appears designed to retain the tooth in the proboscis. I have quite recently found a complete nereid worm in the body of *Conus aurora*, which has teeth of this type. It is probable that each type of tooth is used against some particular kind of prey. A gaping bivalve might be killed and its flesh ingested when decomposed and the statement made by A. Adams of the "Samarang" (quoted by Tryon) may be founded on fact. He says: "They lead a predatory life boring into the shells of other molluscs for the purpose of sucking the juice from their bodies." We must, of course, discount the idea of boring.

Many *Terebra* radulæ have teeth very like those of some of the Cones, and their poison apparatus is as figured by Troschel.

In the *Turridæ* we have several types of radula to consider. In the simplest form the arrangement of the teeth is as in *Conus*, with formula 1.0.1 and they are evidently employed in the same way. An excellent figure by Sars of the anatomy of *Bela exarata* shows a shaft in situ in the proboscis. The long and very slender teeth of *Lora turricula*¹ are distinctly reminiscent of the wire instruments used by dentists for probing the nerve channels in the roots of human teeth. It seems more than probable that they are used for attacking creatures living in minute burrows.

But in many species there is a central tooth, often minute, but sometimes quite well developed. It is difficult to visualize the employment of such apparatus and still more difficult in the type of radula represented by that of the Northern *Spirotropis*, but not confined to that genus. It is found in several tropical species assigned by Thiele to *Drillia*.

Here we have five lines of teeth (formula 1.1.1.1.1), the centrals insignificant, the laterals broad plates with serrated edges, and the marginals long and pointed but not rolled. As figured by Sars the radula is not situated by the side of the œsophagus, as in *Bela* and *Conus*, but in prolongation of it, the poison duct entering near the front of the radula.

Cooke suggests that we see in *Spirotropis* the primitive toxoglossate radula, and it is tempting to believe with him that we can trace the

¹ Cooke, 1895, fig. 113.

evolution of the teeth of *Conus* therefrom by the shedding of all but the marginals. But I see difficulties. For instance, the rolled up teeth of *Conus* are more likely to have evolved from a form of plate, like the lateral, than from a tube, like the marginal of *Spirotropis* even if we allow that some *Turrids* of the second type could have evolved from the third by the loss of the lateral.

As to the radula of *Cancellaria*, also included in the *Toxoglossa*, the long and very slender blades are probably used, like the teeth of *Lora*, to penetrate minute burrows.

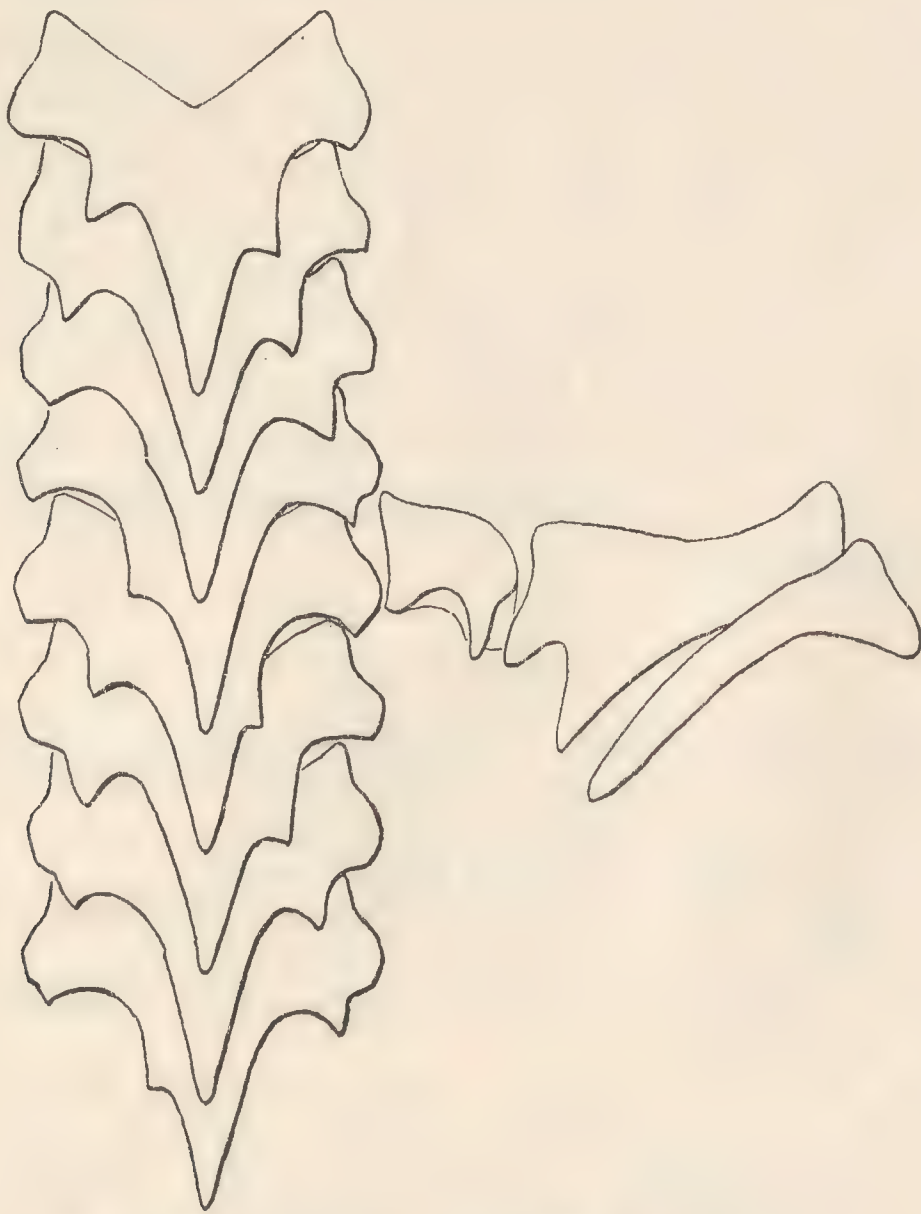


FIG. 2.—*Octopus vulgaris* Lam. Guernsey.

Eight central teeth and one set of laterals (marginal plates omitted). $\times 55$.

In conclusion let us glance at some *Cephalopods*. In *Sepia officinalis* the radula is composed of fifty rows of strong, pointed teeth, five in each row, suitable for tearing flesh from prey held by the jaws and conveying the pieces to the œsophagus. The œsophagus is also furnished with spiny processes which further ensure the passage of food to the stomach. In the front end of the extracted radula the teeth are found to be blunted.

The radula of *Octopus vulgaris*, which is more elaborate than that of *Sepia*, will provide our last and not least interesting problem. It is much longer, having twice as many rows of teeth arranged in

nine lines, if we include the unarmed marginal plates. The central tooth is furnished with a prominent sharp mesocone; the line of centrals seen through the open beaks resembles the teeth of a circular saw, and doubtless its purpose is that of finishing the work, begun by the beaks, of carving crustaceans. The two inner lines of laterals are armed with large cusps while the outer line consists of long conical teeth resembling the teeth of *Sepia*.

When we examine the extracted radula we find signs of very hard wear in the front portion, greatest on the central teeth, which are often worn quite flat, but also severe on the laterals.

In the unworn part of the radula we notice that the cusps on the central teeth are not symmetrically placed, and that their position differs in the successive rows, the succession following a law by which, in any row, the cusp is lower than in the row in front of it (Robson). Such an arrangement is peculiar to certain genera of *Octopodidæ*. I venture to suggest that it is of advantage in varying the depth of bite in the food material (Fig. 2).

The other side of the problem, concerning the development of such teeth, I present to Cytologists, together with the problem of the cusps in *Peristernia*.

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DREDGING IN LOCH LINNHE.

By W. FOWLER.

(Read before the Society, 12th December, 1936.)

MISS GAFFNEY and I spent September and October last at Onich, on Loch Linnhe, near Fort William, and for six weeks dredged the Rev. G. A. F. Knight's ground of 1891.

We certainly have made several additions to his list, but this is not surprising, seeing that Knight did all his work single-handed with no one in the boat to help, and the dredge he then used was a very small and light one, weighing only 9 lb. We had an excellent new dredge, weighing over 30 lb., and in addition an excellent boatman and dredger, John MacGregor, the best man I have come across anywhere in the past eight years; it is chiefly due to his skill and knowledge that we did as well as we did, while we had also the best six weeks of calm weather that I have ever experienced. I am not mentioning many of the commoner species, but among things we got alive are the following, which Knight either did not get at all or only found in a fragmentary condition: *Cuspidaria abbreviata* Fbs. (one); *Pecten maximus* L.; *Chlamys nivea* Macg., white form only, at Oban we found one mottled with purple; *C. opercularis* L., *septemradiata* Müll., *tigerina* Müll., *striata* Müll., *similis* Laskey; *Nuculana minuta* Müll.; *Nucula sulcata* Bronn; *Astarte elliptica* Brown; *Glossus humanus* L. (two small living and one large dead); *Puncturella noachina* L.; *Mangelia attenuata* Mont.; *Tonicella marmorea* F. (mostly small); *Lepeta fulva* Müll.; *Turbonilla crenata* Brown; *Odostonia umbilicaris* Malm; and *Capulus ungaricus* L.

Other living species, which Knight also got, included: *Cusp. cuspidata* Brown, fairly common; *Astarte montagui* Dillwyn, common in one spot; *Lyonsia norwegica* Gm.; *Cultellus pellucidus* Penn., common and fine, but the dredge broke many; *Abra alba* Wood, and *nitida* Müll.; *Velutina velutina* Müll.; *Cylichna cylindracea* Pennant; *Lora turricula* Mont.; and *Mangelia brachystoma* Phil.

The best catch that we had by shore-collecting was *Thracia villosiuscula* Macg., but it was very scarce and digging for them at Cuilchenna at three separate tides only produced about a dozen altogether. With them we also found *Mya truncata* L. and *Cochlodesma praetenue* Mont.

Life Membership Fund.

<i>Dr.</i>			<i>Cr.</i>	
	£	s. d.	£	s. d.
To Amount of Fund, 1st January, 1936	342	12 0		2 6
„ Composition Fee	6	6 0		8 6
„ Dividends and Interest	15	11 0		348 18 0
	£364	9 0		£364 9 0

Research Fund.

	£	s. d.	£	s. d.
To Amount of Fund, 1st January, 1936	233	19 5		245 2 9
„ Dividends and Interest	11	3 4		
	£245	2 9		£245 2 9

BALANCE SHEET.

LIABILITIES.

Annual Subscriptions paid in advance	5	15 0
Provision for Glass-topped Boxes	1	5 0
Provision for Authors' Reprints	6	0 0
Life Membership Fund	348	18 0
Research Fund	245	2 9
Balance of Income and Expenditure Account—		
As on 1st January, 1936	31	6 1
For 1936	16	8
	32	2 9
	£639	3 6

ASSETS.

	£	s. d.	£	s. d.
<i>Investments.</i>				
4% Funding Loan, £408 4s. 11d., cost	350	0 0		
4½% Conversion Loan, £202 13s. 3d., cost	200	0 0		
3½% Conversion Loan, £40 11s. 8d., cost	40	0 0		
Cash at Bankers	590	0 0		
	49	3 6		
	£639	3 6		

NOTE.—Assets in addition to those set out in the Balance Sheet are (a) Library, (b) Cabinets and Collections, (c) Stock of unsold publications, (d) Annual Subscriptions in arrear.

Audited and found correct.

C. H. MOORE.

A. K. LAWSON.

11th January, 1937.

CHAS. OLDHAM,
Hon. Treasurer,
31st December, 1936.

MOLLUSCA OF THE SHEEP PONDS ON THE EASTBOURNE DOWNS.

By G. SHRUBSOLE.

(Read before the Society, 8th February, 1936.)

A PAPER on these ponds was read before the Society in November, 1934, and since that time observation has been continued.

If a map of the Downs is taken and the ponds marked on it, it will be seen that the colonized ponds occur all over the ground ; they are not confined to particular parts. The distribution has been very general. Possibly all the ponds at some period or other have contained mollusca, for where a pond is now barren, in practically every case it is now, or is known to have been, in a condition which would kill off any snails it might have held.

The fact that the distribution has been so general appears to be against the theory that ducks and other wading birds, with possibly water-beetles (*Dytiscus*), can have effected the transfer of the mollusca from the marshes to the ponds.

There is no evidence to show that ducks, coots, or water-hens have ever frequented these ponds. They and the ground around them can never have been attractive to such birds. It is difficult to believe that coots or water-hens would ever attempt the flight, and if an occasional duck did drop on a pond the chance of that pond being colonized would be most remote, and of a general colonization practically *nil*.

The opinion of four or five local naturalists who have known the Downs for many years has been asked, and all agree that they have never seen one of these birds on the Downs, nor found any of their feathers near a pond. Moreover, if ducks did use the ponds one would expect they would select the more remote and quietest, yet we find that the farm ponds and others close to cottages contain snails. It is difficult to imagine that snails, especially *L. peregra* could survive in a cement pond frequented by ducks. There is no weed for cover and the snails generally are clearly visible.

Although Clement Reid in his paper "The Natural History of Isolated Ponds" does not consider human agency has played much part in the transport of weeds and animals to these ponds, giving as his reason the rarity of strangers or traffic visiting these Downs who might act as conveyers, there are other ways in which it may have acted which he does not discuss.

All these ponds are artificial ; originally made to supply water when the farmers on the lower slopes sent their sheep up to graze. From all the farms tracks ran on to the Downs and up these would be

taken the materials for constructing the ponds. The old puddled ponds were usually made with five or six layers of different materials, of which straw was one. Any water required for the puddling must have been brought up also, there being none on the top, and this water coming from the lowlands could scarcely fail to contain snails in most cases. When more ponds were needed, water from those first made might be used, probably containing snails, and in this way from its original making every pond had a good chance of being colonized by mollusca. But there was yet another way in which human agency could colonize these ponds or replenish their stock of mollusca.

Droughts occur on the Downs fairly frequently. In recent years there were droughts in 1887, 1893, 1911, 1921, 1933, 1934, and 1935.

These dry periods have been recurring as long as ponds have been on the Downs. At such times the ponds get very low and there is a shortage of water for the stock. Vegetation is dried up and water is a necessity.

During the drought of 1935 Eastbourne Corporation, which now owns Black Robin and Bullock Down Farms, was supplying both and some of the ponds with water, sent up in the town's motor water-cart. This may have been the case in 1933 and 1934 also.

But before these modern supplies were available (water is now laid on at Friston) farms had to cart water up, and the nearest supply would be ponds or large ditches at the foot of the Downs, all of which contain mollusca.

Beckett, in *Spirit of the Downs*, records in the drought of 1893 at Toy Farm, south of Firle, two or three hundred gallons of water had to be carted to the farm pond every day for the use of the stock during a period of seven weeks. From the map the nearest water appears to be the Ouse marshes. Toy Farm is only a little over 4 miles from these Downs, where no doubt the same shortage would be experienced.

The shepherd on Beachy Head, when asked how the farms managed in the past for water during droughts, replied : " They had to fetch water up ; stock cannot do without it." The task is not so great as it may appear at first sight, as each farm would deal with its own supply according to the stock it had on the Downs. Formerly when sheep-grazing was more flourishing water was probably taken up at several points round the Downs, and may have assisted in making the distribution of mollusca general.

It may be asked, if the mollusca have been introduced into these ponds by the use of marsh-water, why are only two species found in them now ? At least a dozen species are equally common in such water. It is probably a case of survival. These ponds are now

concrete or cement. Usually there is little or no weed; food is limited in quantity and variety. It appears to be largely in the nature of algæ, and *S. lacustre* finds something when mud is present. In dry summers the water gets low. *L. peregra* survives under these conditions up to a point. The question of food probably eliminates other common species. There are still two puddled ponds on these Downs. They contain six and four species respectively.

It is reasonable to believe that human agency, in the ways mentioned, rather than ducks, has stocked these ponds with mollusca. If ducks had frequented these ponds it is likely there would have been no snails, for with hard sides and bottom and only a comparatively small deposit in the middle of the ponds, snails could not have survived.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND

636th Meeting (the Sixtieth Annual Meeting) held in the Rooms of the
Royal Society, 10th October, 1936.

The President (Lieut.-Col. A. J. Peile) in the chair.

Present : Drs. A. E. Boycott, H. E. Quick, Stanley Colyer, and J. W. Jackson, Messrs. J. G. Dalglish, R. A. R. Priske, A. E. Salisbury, E. D. Bostock, H. E. J. Biggs, G. Shrubsole, A. P. Gardiner, A. Blok, J. R. le B. Tomlin, D. C. Thomas, G. C. Spence, J. D. Dean, R. Winckworth, J. E. Cooper, C. Oldham, A. E. Ellis, C. Diver, J. E. Forrest, A. Wrigley, H. W. Worsfold, Mrs. Peile, Mrs. Morehouse, Mrs. Bowell, Miss Nora Fisher, Miss J. D. Robertson, Miss K. M. White, Mr. and Mrs. R. H. Moses, Mr. and Mrs. H. C. Fulton, Mr. and Mrs. A. S. Kennard, Mr. and Mrs. W. J. Davey, Mr. and Mrs. G. L. Wilkins, and the Rev. H. Purefoy Fitzgerald.

Of those present, two, the Rev. H. Purefoy Fitzgerald and Mr. E. D. Bostock, had been members since 1884, and one, Mr. J. R. le B. Tomlin, since 1886.

Alteration in the Rules.

Immediately prior to the General Meeting a Special Meeting was held, and, on behalf of the Council, the Hon. Secretary moved that Rule 8 be altered to read : "The Presidency shall not be tenable for more than two years in succession, and the President is expected to give, at least, one address." The remainder of the rule remains in force.

The motion was carried unanimously.

Appointment of Scrutineers.

Messrs. A. E. Salisbury and R. A. R. Priske were elected Scrutineers.

Appointment of Auditors.

Messrs. C. H. Moore and A. K. Lawson were re-elected Auditors.

Candidate Proposed for Membership.

Stanley Colyer, M.D., Westhill, Mayfield, Sussex (introduced by J. R. le B. Tomlin and J. W. Jackson).

Members Deceased.

Dr. L. Faustino, James A. Grieg, H. Sowden, and R. J. Welch.

Papers Read in Title.

"Apparent Disappearance of *Lymnæa peregra* from Friston Pond, Eastbourne Downs," by G. Shrubsole.

"Occurrence of *Hydrobia jenkinsi* Smith on Beachy Head," by G. Shrubsole.

"Infant Mortality of Mollusca," by L. E. Adams.

Annual Reports.

The Annual Report of the Council ; the Reports of the London, Leeds, and North Staffs. Branches ; the Reports of the Curator, and of the Recorders for Marine and Non-Marine Mollusca, were presented and adopted.

Election of Officers and Council for 1936-7.

The Scrutineers reported that the Officers and Council for the year 1936-7, as nominated by the Council, had been unanimously elected. (See p. 289.)

President's Address.

Lieut.-Col. A. J. Peile gave his Presidential Address on "Some Radula Problems".

On the motion of Dr. A. E. Boycott, seconded by Mr. A. E. Salisbury, a cordial vote of thanks was passed to Lieut.-Col. Peile for his address.

A vote of thanks was also passed to the authorities of the Royal Society and the Manchester Museum for the use of rooms for the meetings of the Society.

The members and their friends were then entertained to tea by the President and Mrs. Peile.

Exhibits.

By Mr. A. E. Salisbury: *Cypræa hirasei* Roberts, from Kii, Japan; marine shells recently collected in Guernsey, including a series of *Trivia monachus* da Costa to show growth of shell; *Nassarius incrassatus* Ström, up to 18×10 mm. in dimensions; *Philbertia purpurea* Mont., a specimen 19 mm. in length; *Patelloida virginea* Müller, a large form, one measuring 16×13.5 mm.

By Mr. G. L. Wilkins: Series of *Oliva*, showing variations especially in *Oliva irisans* Lam. and *O. oliva* L.; *Nucella lapillus* L., from Jersey; a model of *Ficus* taken from the figure in the *Voyage of the Samarang*.

By Mr. J. Digby Firth: *Helicella obvia* Htm., *A. arbustorum* L., and *Clausilia biplicata* Mont., from Innsbruck; *Arion ater* var. *oculata* from Cookridge, Leeds.

By Mr. H. J. Armstrong: A brown example of *Arion ater* from Cookridge, Leeds.

By Dr. W. F. Buckle: Fry of *Crepidula fornicata* L., on a shell of *Neptunea antiqua* L. from Walton-on-Naze.

By Mr. J. G. Dalglish: Japanese mollusca; specimens showing adaptations of marine forms to fresh water.

By Mr. J. E. Cooper: Series of *Pleurodonte*, including seven species of the section *Isomeria* and twelve of *Labyrinthus*.

By Colonel H. C. Winckworth: Photos and shells (1) *Tridacna* ground—live and dead coral; (2) *Tridacna crocea* Lam. in burrows; (3) *T. squamosa* Lam. in situ; all taken in South Andaman in March, 1936.

By Mrs. Morehouse: Marine shells from Jersey.

By Mr. J. R. le B. Tomlin: Two examples of *Cypræa fultoni* Sow., from deep water off the Natal coast; a number of species of *Ancilla*; scalariform *H. nemoralis* from Bundoran; reversed and other monstrosities of *H. aspersa*; two *Eremina zitteli* Boettger from Bir Kanyas in North Africa.

By the President: Three new species of land shells from Mauritius; radulæ of the following: *Natalina caffra* Fér., *Crepidula fornicata* L., *Macrochlamys glauca* Pfr., *Peristernia leucothea* Melvill, *Octopus vulgaris* Lam., *Spirotropis carinata* Ph., *Conus dictator* Melvill, *Conus betulinus* L., *C. striatus* L., and the following Mitridæ: *M. fusca* Sow., *Imbricaria acuta* Sow., *Chrysame mariæ* A. Adams, *Scabricula circula* Kiener, and *Vexillum exasperatum* Gmelin.

By Mr. A. S. Kennard: Very large *Anodonta anatina* from Stackpole Ponds, Pembrokeshire; *Retinella petronella* Ch., from Holocene at Calf Close, Brickhills Farm, Broughton, Brigg (first English record); *Unio auricularius*, specimen dredged in River Thames at Barn Elms (extinct in England); dredged in River Oise at L'Isle Adam, Seine-et-Oise (locally extinct), from coll. Abbé Breuil; *U. littoralis* Cuv., from some locality and collection, showing differences between recent and fossil shells.

ANNUAL REPORT, 1935-6.

THIS is the Sixtieth Annual Report of the Society, which was founded on 12th October, 1876. Therefore, this year we celebrate our sixtieth anniversary almost to the very day. A short history of the Society by the Hon. Secretary is printed in Volume 18, January, 1927, p. 65. This was read at the Jubilee Meeting on 16th October, 1926. Since that meeting there have been many changes. John W. Taylor, one of the two remaining founders, has passed away, and other prominent members have died.

Since our last Annual Meeting eight members have died, one has resigned, and two have been struck off the list. Eight new members have been elected. The membership now stands at 210, including three Honorary Members.

The deceased members are C. H. Schill, H. Coates, Rev. R. W. Nevill, G. H. Weaver, Dr. Leopoldo Faustino, James A. Grieg, H. Sowden, and R. J. Welch.

Among the recipients of H.M. the King's Birthday Honours is one of our members, and a past President, viz. E. W. Swanton, who is now M.B.E. (Civil Division).

Five ordinary meetings have been held at the Manchester Museum by the continued permission of the authorities. In addition, on 2nd November, a joint meeting with the Yorkshire Conchological Society was held at Leeds. There was a good attendance, and Mr. H. J. Armstrong gave an interesting talk on "Shell Money". Many specimens were shown by the lecturer and others. On 4th April a similar joint meeting took place at the Manchester Museum, and again there was a good attendance and an excellent display of specimens. The President, Lieut.-Col. A. J. Peile, who was in the chair, exhibited a series of land shells found in Bermuda, but of exotic origin, and gave a short account of the conditions affecting their introduction. He also read a short note on "Some Tristram Types" (see p. 254).

Two Special Exhibits were held during the year, these being "Lancashire and Cheshire Marine Mollusca" and "British Non-Marine Mollusca illustrating attacks by various enemies".

Twelve notes and papers were read during the year. Three numbers of the *Journal* have been issued to members since the last Annual Meeting, viz. Vol. 20, no. 6, 4th December, 1935, with 32 pages of text and two text-figures; Vol. 20, no. 7, 24th March, 1936, with 32 pages of text, 2 plates, and 5 text-figures; and Vol. 20, no. 8, 1st July, 1936, with 32 pages of text and 1 text-figure.

Additions to the Library have been received from Dr. A. Mozley, Miss Nora Fisher, Mr. G. C. Spence, Miss T. van B. Jutting, Messrs. R. J. Welch, C. Kraup, J. W. Jackson, C. Oldham, O. Fridthjof, and H. Schlesch.

Additions to the Cabinet have been received from Dr. A. E. Boycott (voucher specimens from Raasay taken by G. H. Harrison); Chas. Oldham (voucher specimens from Salop, Cheshire, and other places); and Hans Schlesch.

RECORDER'S REPORT (Non-Marine Mollusca).

SINCE the last report (Vol. 20, p. 187) sixty new records have been authenticated for the census. The most important is the discovery by G. H. Harrison of *Planorbis dilatatus* in Loch a Mhuilinn in the Isle of Raasay, near Skye (v.c. 104), where it has every appearance of being a native (*Scot. Nat.*, 1936, p. 82); this American species has hitherto been known in Britain only as an introduction to the Lancashire canals, where it was first found by T. Rogers in 1869. *Helix hispida* was also found in a wild part of the same island, which makes it more likely that the dead shells of uncertain age found near buildings in N. Uist (v.c. 110) by A. R. Waterston in 1933, and then taken by A. W. Stelfox at Stromness in Orkney (Vol. 15, p. 224), were something more than casual introductions.

- Cornwall, W. (1). *Vertigo edentula* (P. B. Mason).
 Devon, S. (3). *Acme lineata* (R. Sheppard coll.).
 Wilts, N. (7). *Milax gracilis* (A. E. Boycott), *Paludestrina jenkinsi*,
Pisidium personatum (C. Oldham).
 Dorset, (9). *Planorbis glaber* (J. J. Lavis).
 Essex, S. (18). *Segmentina nitida* (J. Pickering).
 Gloucester, E. (33). *Agriolimax laevis* (A. E. B.).
 Gloucester, W. (34). *Agriolimax laevis* (A. E. B.).
 Monmouth (35). *Limax cinereoniger*, *L. tenellus*, *Zonitoides excavatus*,
Vitrina major, *Helix caperata caperata*, *Vallonia excentrica*, *Valvata*
cristata (C. O. and A. E. B.).
 Shropshire (40). *Planorbis corneus*, *Physa heterostrophica* (C. O. and A. E. B.).
 Radnor (43). *Planorbis glaber*, *Pisidium hibernicum* (C. O. and A. E. B.).
 Carmarthen (44). *Agriolimax laevis*, *Zonitoides nitidus*, *Z. excavatus*, *Phytia*
myosotis, *Planorbis complanatus* (H. E. Quick).
 Montgomery (47). *Milax sowerbii*, *Zonitoides nitidus*, *Bithinia leachii* (C. O.
 and A. E. B.).
 Denbigh (50). *Paludina vivipara*, *Unio tumidus* (C. O. and A. E. B.).
 Cheshire (58). *Pseudanodonta* (C. O. and A. E. B.).
 Durham (66). *Testacella haliotideia* (B. R. Lucas : the record entered in the
Census is of "*T. haliotideia* var. *scutulum*" in 1884 ; see this *Journal*,
 Vol. 5, p. 345).
 Kirkcudbright (73). *Phytia myosotis*, *Planorbis fontanus* (D. K. Kevan).
 Berwick (81). *Vallonia pulchella* (A. R. Waterston).
 Edinburgh (83). *Planorbis fontanus* (D. K. K.).
 Linlithgow (84). *Anodonta anatina* (D. K. K.).
 Fife and Kinross (85). *Pisidium henslowanum* (D. K. K.).
 Perth, W. (87). *Limnæa glabra* (A. R. W. and D. K. K.).
 Ebudes, Mid. (103). *Vertigo edentula*, *Planorbis vortex*, *Pl. nautilæus*, *Pisidium*
cinereum, *P. obtusale* (G. H. Harrison).
 Ebudes, N. (104). *Milax gagates*, *Zonitoides excavatus*, *Helix virgata*, *H.*
caperata caperata, *H. hispida*, *Succinea pfeifferi*, *Planorbis albus*, *Pl.*
dilatatus (G. H. H.).
 Ross, E. (106). *Pisidium personatum* (D. K. K.).
 Mayo, E. (137). *Arion subfuscus*, *A. circumscriptus* (D. Oldham), *Hyalinia*
radiatula, *Ancylus fluviatilis*, *Physa fontinalis*, *Neritina fluviatilis*,
Pisidium pulchellum (C. O.).

MARINE RECORDER'S REPORT.

DURING the past year copies of Winckworth's map of the British area have been printed. This map may be seen in a past number of the *Journal of Conchology*. A map has been devoted to each species, except in the cases of a very few nearly related forms.

The areas in which an animal occurs have been marked in red, while in the margins, made wide for the purpose, the observer's name, and where possible the exact situation and other points of interest, have been inserted.

On behalf of the Society and students in general of the mollusca the recorder thanks the following for great assistance since the last general meeting.

J. E. Cooper.—Lists for the East of England and for many other places.

Dr. N. B. Eales and Miss K. White.—Bangor.

Miss Nora Fisher.—A very full list of records for nudibranchs, including not only her own, but those from a large number of sources. Her paper, "The Marine Mollusca of Magilligan, Co. Derry," has been of great use, especially as information from Ireland has been scanty.

W. Fowler.—Much valuable information of an œcological nature as well as lists for Oban, Scilly Islands, Salcombe, Penzance, and Anglesea.

Mrs. E. Morehouse.—Lists for Tenby district, Robin Hood's Bay, and Jersey.

Dr. H. E. Quick.—South coast of Wales.

Robert Rendall.—A few records for Orkney.

J. Simpson.—Marine Conchology of Dee and other lists for East Scotland. Rare mollusca of the North Sea and Faroe Channel.

G. C. Spence.—North Wales and Anglesea.

R. Winckworth.—Full information of British Loricata and several other groups. His paper on the marine mollusca of Sussex made it possible to treat that part of the coast in a very satisfactory manner.

Miss K. White.—A very full list and many interesting facts for the Isle of Man.

The "Plymouth Marine Fauna" has helped to make the lists for Devon and Cornwall far fuller than those of most other areas.

It is hoped that conchologists will remember that records in Jeffreys, Forbes, and Hanley, and other old works, although of much interest, cannot take the place of the results of present-day observers. Even *Patella vulgata* cannot be marked for a particular area without recent evidence. It is necessary to know where the animals are, not where they were; for example has anyone found *Cæcum imperforatum* or *glabrum* alive during the past twenty years?

Instances are numerous of the disappearance of many species from several places, *Cantharidus exasperatus* used to be thrown up in hundreds at Porthcurnow Cove, but I have failed to find one in my last dozen visits.

It has been found impossible to pronounce records to be new in the majority of cases; one of the very few is that of *Facelina elegans* for Co. Antrim by Miss Fisher. The finding of species new to a place is of frequent occurrence, but not for an area.

Ireland and the East Coast of England are the places about which information, of even the common species, is most needed.

Spirit specimens, or better still, animals alive in damp weed, of *Berthella plumula* (Montagu), from which the new *Berthellina engeli* has been separated, are urgently needed. W. Fowler has sent a large number of specimens from Scilly, but otherwise the appeal for these has met with little response.

CURATOR'S REPORT.

J. W. TAYLOR collection: During the past twelve months the work on the above has been continued. The freshwater specimens in the right-hand tier of the smaller cabinet are now arranged and listed and also the slugs and fossils. The carded land shells in the left-hand tier of the larger cabinet have been arranged and listed.

Some valuable specimens of *Cochlostyla*, etc., in the Musham collection having been found to be attacked by fungus, all these shells have been individually washed with benzine and are now in a much brighter and cleaner condition. The same treatment has been adopted with the whole of the carded land shells of the J. W. Taylor collection.

Several donations to the Library and Voucher Collections have been made during the past twelve months, as per the Hon. Secretary's report.

ANNUAL REPORT OF THE YORKSHIRE CONCHOLOGICAL SOCIETY.

At the last Annual Meeting held in Leeds on 12th October, 1935, the following officers were elected: President: J. D. Firth; Vice-Presidents: Miss K. Morehouse and A. Smith; Hon. Treasurer, J. R. Dibb; Council: As before; Hon. Secretary: E. Dearing; Recorder: H. J. Armstrong.

The first meeting of the new session was devoted to short papers and exhibits. The February meeting being cancelled, the March one was allotted to the President's remarks and general exhibits; seven members attended.

Only three of our members attended the joint meeting at Manchester Museum in April. This was well attended by members of the parent society, and was presided over by Lieut.-Col. Peile.

An excursion to Halifax to investigate the local museums proved successful, although only five members attended.

The June meeting was at York for Askham Bogs, being a joint meeting with York Field Naturalists' Club and Y.N.U. Conchological Section.

Three members attended an excursion to Cridling, Staffs. There were no new records. This was a joint meeting with Doncaster Scientific Society and Y.N.U. Conchological Section.

In September four members attended a ramble to Adel Moor, Leeds.

There are three more meetings to be held to complete the syllabus: The annual meeting in October; a joint meeting with the parent Society in Leeds in November; and a final general exhibits meeting in December. Membership is now 23.

E. DEARING, *Hon. Secretary.*

ANNUAL REPORT OF THE LONDON BRANCH.

NINE meetings have been held with a good average attendance, Mr. A. S. Kennard again occupying the chair. An extremely varied programme has been worked through with every success. Such items as "Mollusca of Isolated Ponds", "Sale Catalogues," "Reversed Shells," "Opercula," and "Sight, Smell, and Hearing of the Mollusca" have helped to make the meetings of interest to all members, irrespective of those items dealing with particular genera and species, of which there were several on the syllabus. These included land shells of Lord Howe Island, *Cantharidus* and *Bankivia*, *Stomatella* and *Gena*, and *Clavagella*.

Some of the subjects were dealt with in a general way, and others by individual members; thus at the November meeting Mr. R. Winckworth gave notes upon Nudibranchs, and again in January on "Larval Forms of Marine Gastropods". In March Lieut.-Col. Peile described the Annulariidae of Jamaica, and in February the President and Mr. Blok dealt in a similar manner with the land shells of Norfolk Island.

Altogether I may safely say a good year, although the membership still remains disconcertingly low.

GUY L. WILKINS, *Hon. Secretary.*

ANNUAL REPORT OF THE NORTH STAFFORDSHIRE BRANCH.

It gives me much pleasure to report that W. E. Alkins, D.Sc., has been unanimously elected President of this branch. Dr. Alkins is well known in conchological circles, and we feel sure that during his period of office he will prove a stimulus to our activities. Many rambles in search of mollusca have been made by members during the year. Messrs. J. and W. Hill report a thriving colony of *H. striolata* at Leek Canal Wharf, where the var. *alba* has been quite common. On a hedge bank at Basford, near Leek, three examples of the rare var. *fascialba* of *H. nemoralis* were taken. The shells have a broad white calcified band round the body whorl, except near the lip, where the normal black band is strongly developed; it is a very striking variety.

On 10th September between Cheddleton and Wall Grange an unusual var. of *H. nemoralis*, var. *sexfasciata* was taken, having six bands; formula according to Taylor's monograph is 123×45 , the extra band round the body whorl is very fine.

In the same locality two *H. nemoralis* var. *castanea* were obtained. They are beautiful shells, the colour of horse-chestnut. This is the first time we have taken this var., except on the limestone, where, of course, it is common, but the two shells mentioned are much richer in colour. Along this length of

the canal bank at Cheddleton the normal five-banded shell is not at all common, most of the shells being 00300 or 00000.

From Messrs. H. Emmett and J. H. Goodson, I have the following notes : *H. nemoralis* var. *undulata*, very common in Ricklow Dale, so plentiful, in fact, that this variety appeared to be the prevailing type there. Both *H. lapicida* and *H. itala* were much in evidence and very active at 4 a.m. on one visit to Ricklow Dale, 21st June. At Lathkill Dale, near Bakewell, we were interested to find *A. fluviatilis* approaching the very white var. *alba* of Dovedale, but these Lathkill ones were a little greyer, more of an intermediate between type and the Dovedale var. *alba*. *B. tentaculata* ; exceptionally well developed specimens in plenty in canal basin at Stanley.

Some years ago I introduced a few specimens of *M. gagates* in my garden at Normacot. They have multiplied exceedingly ; both the type and var. *plumbea* are now common.

B. BRYAN, *Hon. Secretary*.

637th Meeting (Joint Meeting with the Yorkshire Conchological Society)
held at Leeds, 14th November, 1936.

Mr. J. Digby Firth, F.L.S., F.R.E.S., President of the Yorkshire Society, in the chair.

Members present : Messrs. J. W. Jackson, E. Dearing, G. F. Sheand, A. K. Lawson, C. H. Moore, J. C. North, H. J. Armstrong, G. C. Spence, Mrs. Morehouse, and Miss K. M. Morehouse.

Election of New Member.

Dr. Stanley Colyer.

Candidates Proposed for Membership.

George Ivor Crawford, M.A., 1 Dryburgh Road, Putney, London, S.W. 15 (introduced by Lieut.-Col. A. J. Peile and J. R. le B. Tomlin).

E. H. Madge, M.B., B.Sc. (Lond.), M.R.C.S. (Eng.), Victoria Hospital, Quatre Bornes, Mauritius (introduced by Lieut.-Col. A. J. Peile and Dr. A. Tindell Hopwood).

John Henry Goodson, 67 Eaton Street, Hanley, Stoke-on-Trent (introduced by B. Bryan and J. Wilfrid Jackson).

Zoölogisch Museum (Professor Beaufort, Director), Plantage Middenlaan 53, Amsterdam C., Holland (introduced by J. R. le B. Tomlin and Miss T. van Benthem Jutting).

Papers Read.

"An Unusual Habitat of *Helicella caperata*," by C. Oldham.

"*Nucella lapillus* at Knott End, Fleetwood," by C. H. Moore.

"The Nomenclature of the British Nudibranch Mollusca," by Miss K. White.

"Mollusca destroyed by Frost," by J. R. le B. Tomlin.

Exhibits.

By Mr. G. C. Spence : A large series of *Achatina* and *Limicolaria*. These were fully described by Mr. Spence, who gave an interesting talk on their systematic features and their general distribution.

By Mrs. Morehouse : *Achatina fulica* Fér. (rich in colour) from Calcutta and the Federated Malay States ; also series of *Clausilia*.

By Mr. A. K. Lawson : *Anodonta cygnea* L. and *Anodonta* sp. from Lymm Dam, Cheshire.

By Mr. C. H. Moore : Interesting specimens from the J. W. Taylor collection, including *Lymnæa auricularia* from Kirchohm ; sections of

Vivipara vivipara and *contecta*; *Lymnæa pereger* (sinistral form) from pond near Leeds; hybrid *Lymnæa stagnalis* × *auricularia*. Also *Nucella lapillus* from Knott End to illustrate his note; *Helicella caperata* and distorted form, *Vitrea lucida* and *Vertigo pusilla* from Grange-over-Sands; *Clausilia bidentata*, slender form, from Lakeside Road, Windermere; *Lymnæa pereger* with reflexed lip from Dewsbury, also photographs of the same; *Bulinus brazieri* (the host of the liver fluke) from New South Wales.

By Mr. H. J. Armstrong: North American shell-money from an old Indian grave, Connecticut; shell-money discs from ancient China (140–86 B.C.); also African and other shells.

By Dr. J. W. Jackson: *Neptunea despecta* (L.) var. *subantiqua* M. & R., one specimen, dredged Tromsø, 30–50 fms. (Stirrup coll. ex Karl Pettersen); one specimen, Giesvoer, Nord Cap (Stirrup coll.); four specimens, Porsanger Fjord, Nord Cap (Darbishire coll.). *Neptunea sinistrorsa* (Desh.), two specimens, Vigo Bay, Spain (Darbishire coll. ex McAndrew); one specimen, Malta (Darbishire coll.). *Neptunea contraria* (L.), many specimens, including giant gerontic examples, from Red Crag localities in East Anglia, for comparison with the last (Darbishire coll.). *Neptunea antiqua* (L.), sinistral specimens from the mouth of the Thames (Darbishire coll.). All the above from the Manchester Museum collections. Also *Scutus anatinus* (Donovan) (= *Parmophorus australis* Lam.) from S.E. Australia. It was pointed out that a smaller form of this *Patella*-like shell, figured by Rumphius in 1741 from Amboyna, was named *Patella unguis* by Linne in 1758. This was later erroneously referred to the Brachiopod genus *Lingula* by several authors and has led to much confusion.

638th Meeting, held at the Manchester Museum, 12th December, 1936.

Mr. G. C. Spence in the chair.

The Librarian reported a number of additions to the Library.

Election of New Members.

G. I. Crawford, Dr. E. H. Madge, J. H. Goodson, Zoölogisch Museum of Amsterdam.

Member Resigned.

John R. Dibb.

Papers Read.

"Mollusca dredged at Onich on Loch Linnhe," by W. Fowler.

"Obituary of Harry Sowden," by Dr. J. S. Gayner.

"Mysticoncha, a new generic name for Caledoniella," by J. D. Dean.

"Note on a letter from George Humphrey to W. Swainson, 1815," by Dr. J. W. Jackson.

Exhibits.

By Mr. F. Taylor: Shells from Jamaica collected by Mr. and Mrs. John Armitage; two specimens of *Thelidomus aspera* (Fér.) taken alive on bananas at Oldham; a number of interesting shells from Droylsden district, Lancashire, including many specimens of *Amnicola taylori* (Smith); *Trochoidea elegans* (Gmel.), from Chaldon, Surrey; *Vallonia costata* (Müll.) and *Vallonia* sp. from South Coulsdon, Surrey; large examples of *Helicella virgata* (da C.) from Norbreck, near Blackpool, Lancashire; *Paludestrina jenkinsi* (Smith) and var. *carinata* from the Boating Lake, Alexandra Park, Oldham, and *Clausilia biplicata* (Mont.) from Purfleet, Essex.

By Mr. G. C. Spence: *Nucella lapillus* (L.) from many localities.

By Dr. J. W. Jackson: Giant specimen of *Neptunea antiqua* (L.) from off Aberdeen (Darbishire coll.): *Neptunea antiqua* (L.) var. *striata* Jeff., from the Smalls, Pembrokeshire, and from off the S.W. of Ireland (= *N.*

despecta of some lists) (both J. Kidson Taylor coll.). The above are in the Manchester Museum

By Miss Fisher (on behalf of Liverpool Museum) *Nucella lapillus* (L.) from many localities, including a very large specimen from Rush, Co. Dublin (coll. A. W. Stelfox, May, 1936); Rhoscollyn Bay, Anglesey (var. *imbricata*, ex coll. Eyton); White Bay, N. of Moville, Co. Donegal (coll. R. MacDonald). *Monodonta lineata* (da C.) from Killowen, Co. Down (coll. Fisher); Balbriggan, Co. Dublin (coll. Stelfox and Fisher); Holyhead (Stelfox). Large series of *Littorina saxatilis* (Oliv.) from many localities (mainly coll. Fisher).

There was a special exhibit of "Favourite Species" and many interesting examples were shown.

639th Meeting, held at the Manchester Museum, 9th January, 1937.

Mr. G. C. Spence in the chair.

Candidate Proposed for Membership.

Robert B. Janson, F.R.E.S., 44 Great Russell Street, London, W.C. 1 (introduced by J. W. Jackson and G. C. Spence).

Member Resigned.

L. C. Hann.

Papers Read.

"On Distinguishing the Shell of *Anodonta cygnea* from that of *A. anatina*," by H. H. Bloomer, F.L.S.

"Some New Australian *Thersites*," by W. J. Clench and A. F. Archer.

"Notes on *Potadoma graptaconus* Pils. and Beq.," by G. C. Spence.

Exhibits.

By Mr. G. C. Spence: Specimens to illustrate his paper.

By Mr. C. H. Moore: Series of *Clausilia*.

By Miss Nora Fisher: A large form of *Nucella lapillus* (L.) from Penarth, Glamorgan (coll. W. R. Ll. James).

By Mr. J. Davy Dean: Series of shells of *Cypræa*, *Trivia*, *Conus*, *Oliva*, *Olivella*, *Nerita*, and *Ellobium*, sectioned to show the internal structure, and, in some cases, the partial or complete absorption of the internal coils.

By Dr. J. W. Jackson (on behalf of the Manchester Museum): Shell-sections of similar groups, prepared by the late Robert Standen. These shells had been rubbed down more completely than those of Mr. Dean, and the whole internal structure was exposed right back to the initial whorl in cases where absorption had not taken place.

The special exhibit was West Indian Non-Marine Shells.

EDITORIAL NOTES.

It is with the greatest regret that we record the death of J. Davy Dean, a recent President of our Society and for years a regular and enthusiastic contributor to the *Journal*.

Dean's Presidential Address on "Conchological Cabinets of the Last Century" was only published last July (*supra*, p. 225), and I might here print an additional note which he sent me subsequently:—

PHILPOTT AND GORE COLLECTIONS. SWINDON.

Miss A. S. Philpott, of Clapton, London, N.E., bequeathed to the Swindon Museum a collection of British and exotic shells contained in five cabinets. She was interested in this Museum and in the work done on the British

Mollusca by Mr. Charles Herbert Gore, Hon. Curator. The Gore Collection, commenced over 50 years ago, is exhibited in two large table-cases, the Nudibranchs being represented by a carefully executed series of coloured drawings.

Miss van Benthem Jutting writes to point out that in a note on p. 286 we misinterpreted the notation on the cover of *Fauna van Nederland*.

The part referred to is the *second* dealing with Mollusca; the first part, containing Gastropods, Prosobranchs, and Pulmonates, appeared in 1933. It is an equally admirable handbook of 387 pages, by Miss van Benthem Jutting, with 300 text-figures, and the nomenclature is completely up to date.

We can only repeat what we said on p. 286 that such handbooks are much to be desired on our own marine shells. One can only regret one's inability to make adequate use of this series, owing to ignorance of the language in which it is written!

Mr. W. Fowler in litt. mentions the occurrence of *Odost. eulimoides* Hanley living on ears of *Chlamys striata* Müller, in about 30 f. in Kerrera Sound, and of a dead *Myrtea spinifera* Mont. measuring $1\frac{3}{16}$ in. $\times$ $1\frac{1}{16}$ in. These dimensions exceed those given by Jeffreys. Marshall says that the latter's are too large.

Dr. Quick, in the *Proc. Swansea Sci. and F. Nat. Soc.*, vol. i, pt. 9, records the wide and frequent occurrence of *Cecilioides* in Gower, in various subterranean situations. The paper is accompanied by several figures and gives exact details of habitat, food, and life-history. We are able by personal experience to confirm his details of the Llanmadoc colony, which we found quite easily from Dr. Quick's directions.

A paper of great interest to us appeared in vol. i, no. 4, pp. 64-74, of the new Dutch malacological periodical, *Basteria*, last year, written by C. O. van Regteren Altena, of the Amsterdam Zool. Laboratory.

It is written in English and is a most exhaustive account of the continental *Hydrobia steinii* Mts. as compared with *H. taylori* Smith. As long ago as 1904 Messrs. Jackson and F. Taylor pointed out the close resemblance between *taylori* and *steinii* (this *Journal*, Vol. XI, pp. 9-10, where it is spelt *steeni*), but considered that differences existed sufficient to warrant specific segregation. Altena says that he is unable to find shell differences or "any difference in any organ", and that the two species are absolutely synonymous: the living *steinii* are said to tally in every detail with Smith's original account of *taylori*, even to the sulphur spot above each eye to which Smith draws special attention.

Both *steinii* and *taylori* are oviparous. Reasons are given against their assignment to either *Hydrobia* or *Bythinella*, and a new genus *Marstoniopsis* is founded with *H. steinii* Mts. as genotype.

As an instance of the richness of the marine fauna of Hawaii one may cite a paper on the Cypræidæ in the current number of the *Nautilus* by W. M. Ingram.

After eliminating the species which have been falsely assigned to these islands he enumerates twenty-nine which are truly indigenous. The only common one is *caput-serpentis* L., while *tigris* L. is probably the rarest. Five are endemic, viz. *sulcidentata* Gray, *semiplota* Mighels, *tessellata* Sw., *ostergaardi* Dall, and *madagascariensis* Gmelin. He points out that Roberts's remark, in the monograph of *Cypræa*, *Man. Conch.*, vol. vii, p. 194, that *helvola* from the Sandwich Is., "are often pale yellow, faintly spotted, with a whitish base and extremities," only applies to the faded dead shells which were dredged in vast quantities from Honolulu harbour at various times. In Hawaii the species is rarely taken alive.

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It is believed that students of the Mollusca will find material of value to them in these volumes, whether they are interested in species of the world, or in those of a local fauna.

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VOL. 20]

27TH MAY, 1937.

[No. 11

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CONTENTS.

PAGE

On distinguishing the Shell of *Anodonta cygnea* from
that of *A. anatina*.—H. H. BLOOMER, F.L.S. . . . 321

LONDON: Mr. D. Nutt (A. G. Berry), 212 Shaftesbury Ave., W.C. 2.

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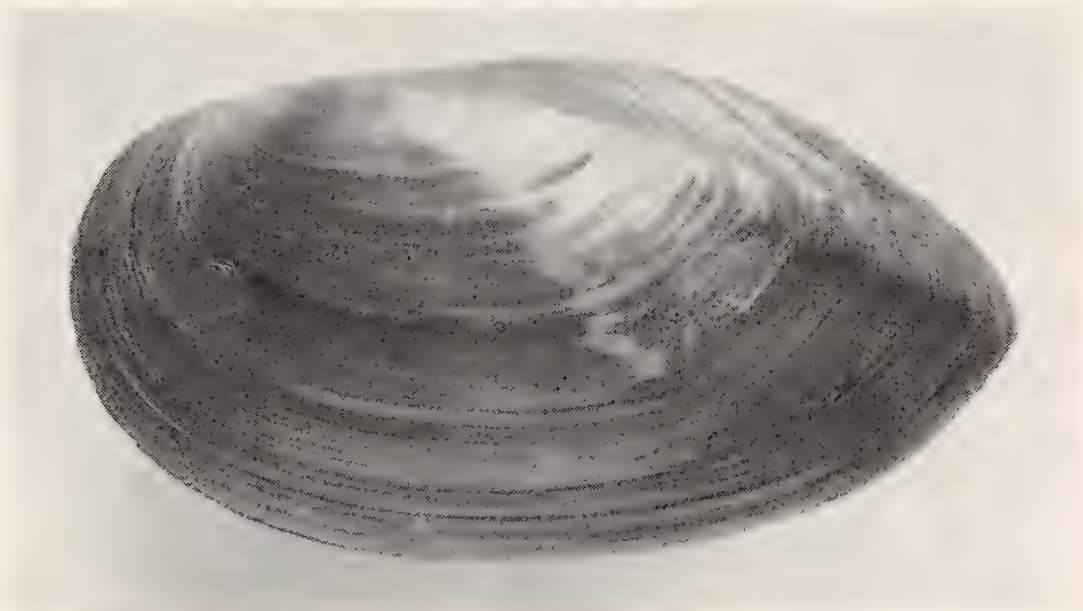
No. 11

ON DISTINGUISHING THE SHELL OF ANODONTA CYGNEA
FROM THAT OF A. ANATINA.

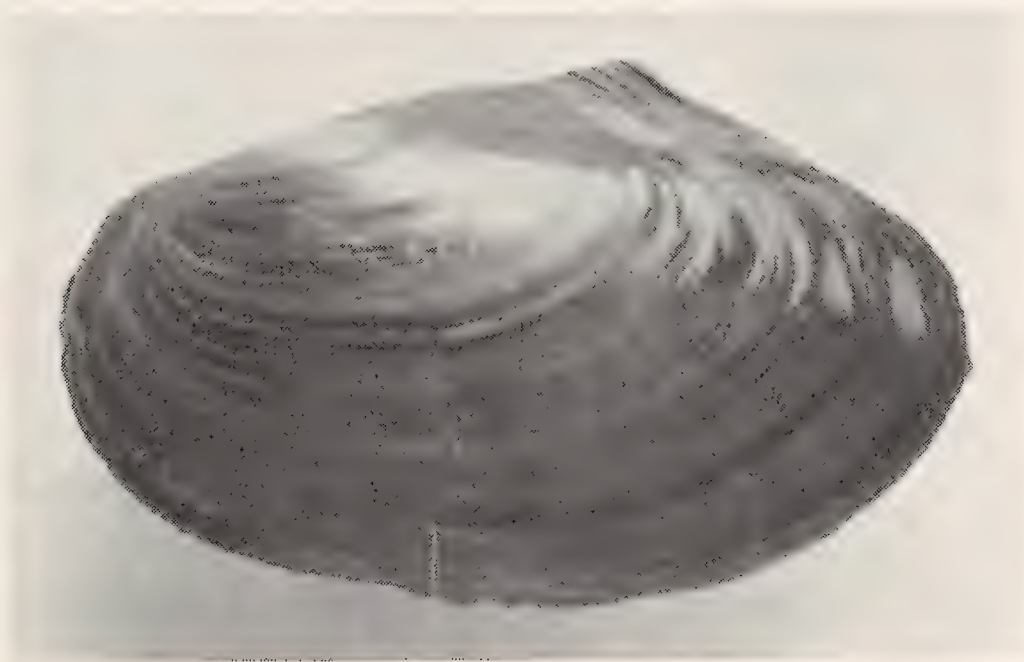
By H. H. BLOOMER, F.L.S.

(Read before the Society, 9th January, 1937.)

WHILST engaged upon the study of the *Anodontas* many specimens have passed through my hands, and knowing the difficulty sometimes experienced in distinguishing the shell of *A. cygnea* from that of *A. anatina* I am venturing upon an attempt to describe, from my point of view, how they can be identified, and in doing so shall treat each species in the widest sense without regard to varieties or forms ; moreover, by adopting the somewhat infrequent method



1. *cygnea*. $\times \cdot 54$.



2. *anatina*. $\times \cdot 75$.

of describing and comparing under common headings the characters of both species, together with the aid of illustrations, I hope my object will be achieved.

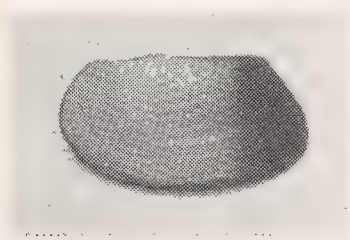
(1) Shape of the shell.

(a) The dorsal border of *cygnea* is either straight even when ascending¹ posteriorly, or anteriorly to the apex of the shell it may curve a little downwards instead of continuing in a straight direction; in some shells it may be curved in the posterior part as well, also be a little irregular. In *anatina* the dorsal edge is more or less ascending in passing from the anterior to the posterior end, sometimes in a straight line, but frequently more or less curved, especially in the posterior part of it, where it may be irregular too as in *cygnea*.

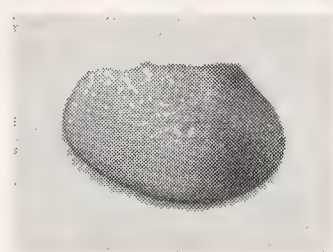
(b) The anterior margin of *cygnea* usually has a broad curve, whilst in *anatina* it is generally comparatively narrow and slopes a little abruptly ventrally, when *anatina* would appear to have relatively a greater width (dorso-ventral measurement) a little posteriorly to the middle of the shell than is usually observed in *cygnea*. In both species the outline of the shell is very variable.

(2) **Ligament.**—In *cygnea* the ligament is long and moderately large, and more or less exposed to view. In *anatina*, though perhaps not so long as in *cygnea*, it is comparatively broader and may be more exposed.

Usually in both species the shell would cover the greater part of the sides of the ligament if in this region the shell were not broken or worn away, and the extent of exposure in a large measure depends upon environment and the age of the animal, hence the older the animal the greater may be the exposure.



3. *cygnea*. × 2.



4. *anatina*. × 2.

(3) **Umbonal rugæ.**—These are elevations of the shell or ridges near its apical part, but distinct from the concentric lines of growth of the shell. In *cygnea* they follow the concentric lines of growth,

¹ The word "ascending" is used in the sense of diverging from the long axis of the animal, the latter being considered approximately in the same plane as a line passing from the centre of the anterior adductor to the centre of the posterior adductor muscle.

whilst in *anatina* they run more or less in a wavy and discontinuous course and only partly in the trend of their general direction do they seem to approximate to the concentric lines of growth. In some specimens of both species they may vary ; also they may bifurcate. The umbonal rugæ are usually plainly seen in smaller shells, but unfortunately in large ones this portion of the shell is very often more or less eroded and the rugæ are only partly discernible or may be obliterated altogether.

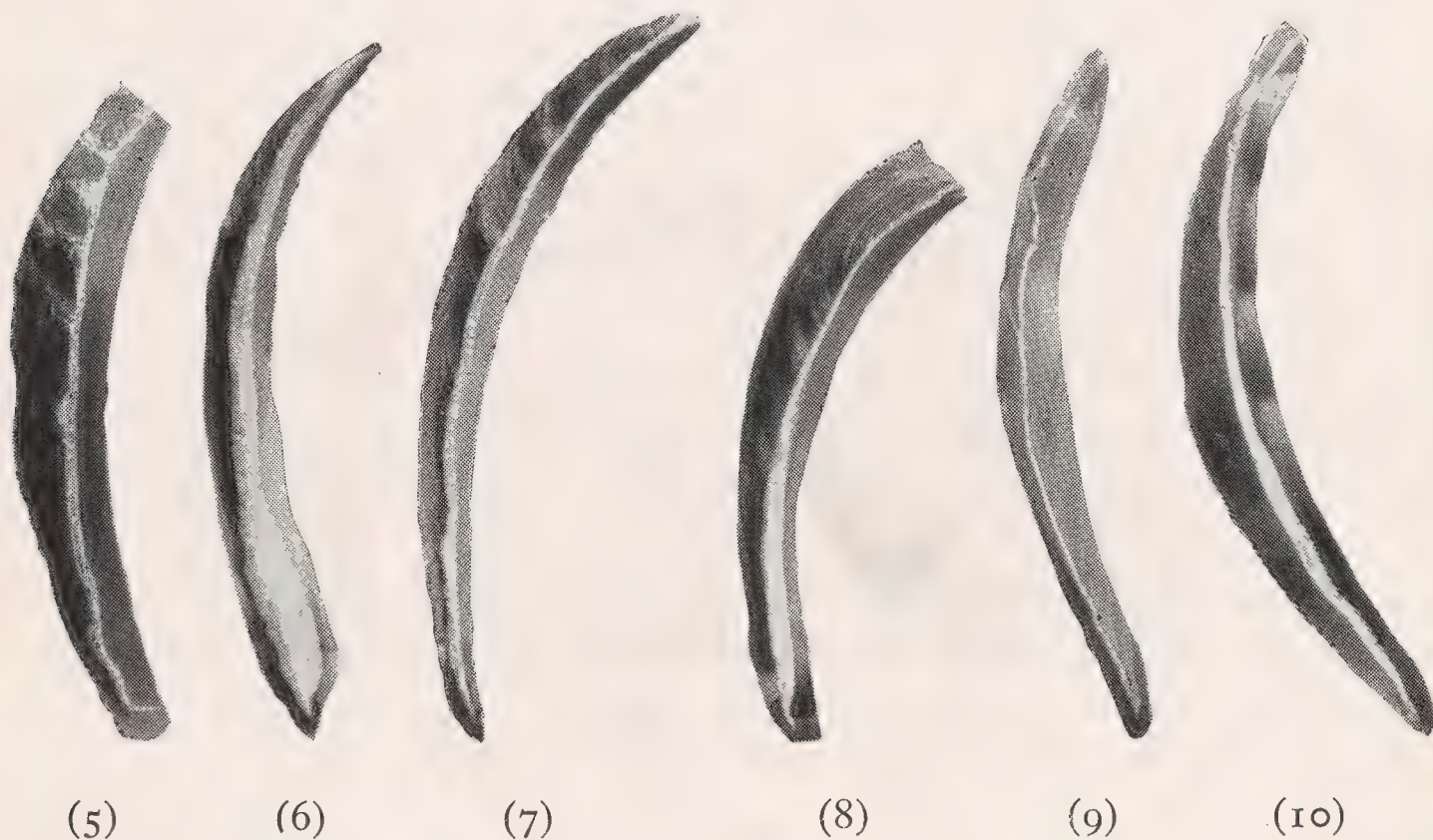
(4) **Outer surface of the shell.**—The shell of *cygnea* shows at intervals a number of close concentric growth lines, more elevated than the intervening growth lines, and these elevated growth lines may be more intensely or differently coloured than the intervening parts, thus forming raised concentric colour bands ; whereas in *anatina*, particularly in some forms, the interspersed series of elevated lines of growth may not be so numerous and not so prominent, although there may be a difference in colouring as in *cygnea* ; furthermore, the outer surface of the shell of *anatina* is probably more frequently smoother, and may have a more polished appearance : this condition applies particularly to the upper central part, sometimes to the whole of the central portion, of the shell. In addition *anatina* often has a tendency to be ventricose ; *cygnea* seldom so except in large shells : size for size *anatina* is usually fuller in the upper middle part than *cygnea*.

(5) **Colour of the shell.**—Yellow or yellowish green is more prevalent in *cygnea* and green or olive green, often of a dark shade, especially in the posterior part, in *anatina*. In some waters *cygnea* and *anatina* are similarly coloured. Coloration, however, would appear to be a very variable factor and subject to environmental influences.

(6) **Thickness of the shell.**—The shell of *cygnea*, which usually is relatively thin, has generally an even thickness throughout, but in *anatina* the shell is thicker in the anterior than in the posterior part, and in the anterior portion, radiating from the umbonal region, becomes increasingly thicker in passing ventrally towards the edge of the shell, near to which it diminishes again : moreover, in some instances, especially in older animals, there may be a still greater thickness between the pallial muscular scar and the edge of the shell. Occasionally the deepness of the pallial muscular scar causes a diminution in thickness before being followed by increased thickness. Sometimes in younger animals (about 2 inches long), as well as in what appear to be normally thin-shelled *anatina*, the increase in thickness, being only slight, is not readily ascertained by

an external examination of the shell. The examination is facilitated, in all cases for that matter, by cutting a section of a valve from the dorsal edge through the umbonal portion to the ventral margin of the shell.¹ Then it will be observed in *anatina* that from below the umbonal region until near the ventral edge of the shell there is a gradual increase in thickness, though it may be only a little, whereas *cygnea*, in a similar section, shows a uniform thickness all the way down, except occasionally for a slight increase in those places where occur the elevated growth lines and near the ventral edge where it may thin off.²

The following series of sections will serve to illustrate the feature of thickness.

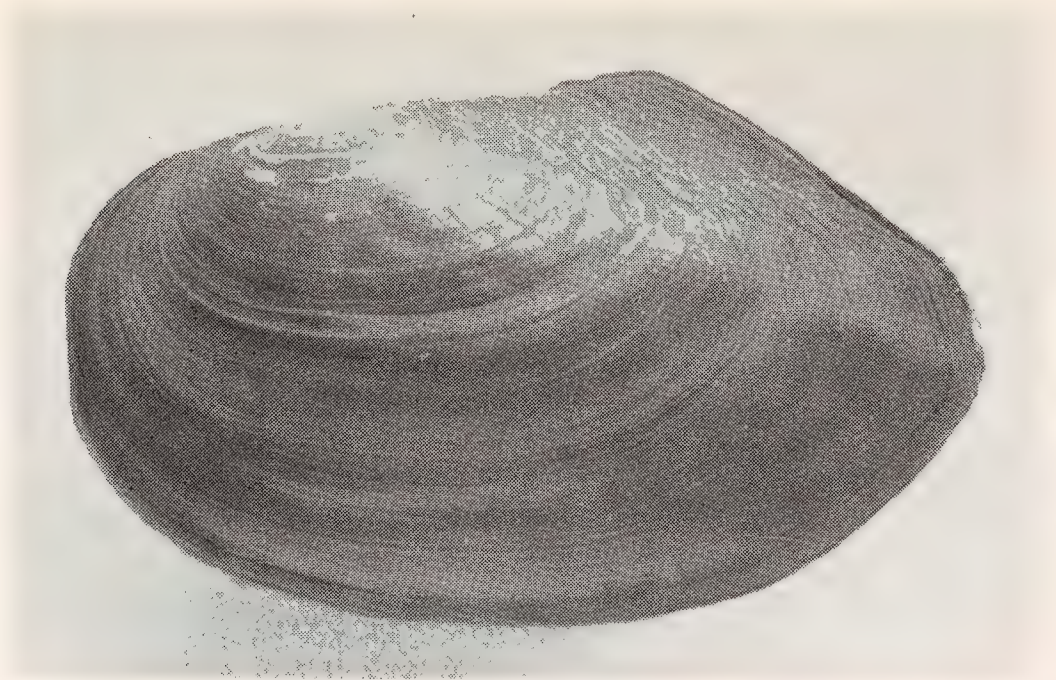
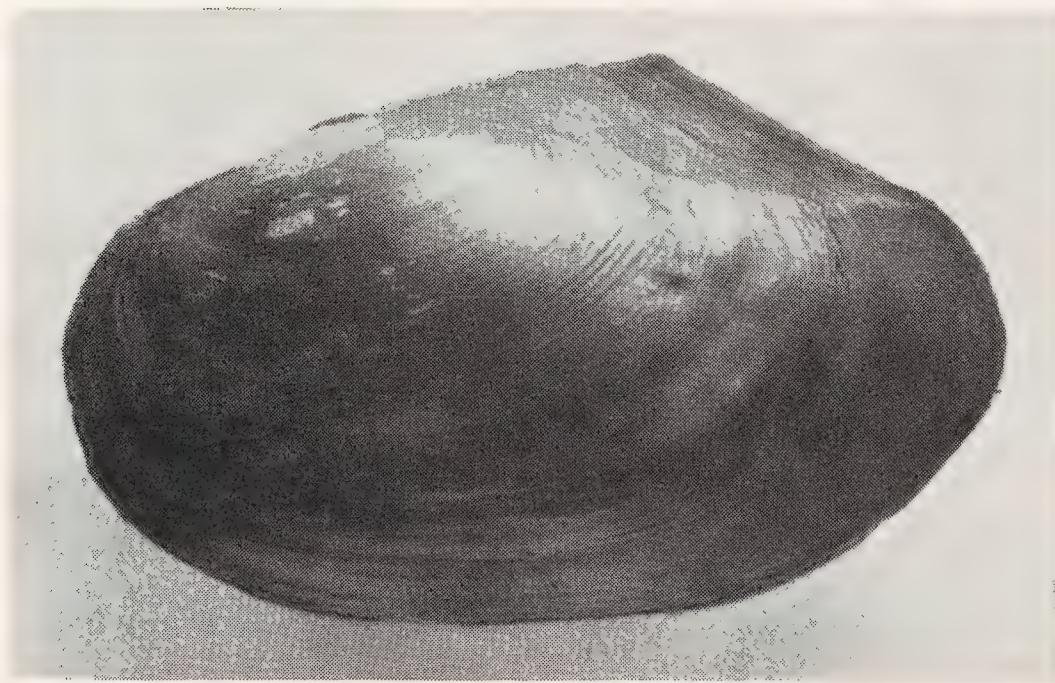


5. *cygnea*. Canal, Chichester (near var. *zellensis*) (11.5).³ × 1.
6. *anatina*. West Drayton Canal, moderately large shell (9.7). × 1.
7. *cygnea*. Pool near Holmwood Station, Surrey, a very large shell (16.5). × .75.
8. *anatina*. Newdigate Park, Surrey, a large shell (12.0). × .71.
9. *cygnea*. Beam Brook, Surrey, a thin shell (6.5). × 1.35.
10. *anatina*. Beam Brook, Surrey, a thin shell (6.5). × 1.35.

¹ A section can easily be cut by using carefully a fine fret saw.

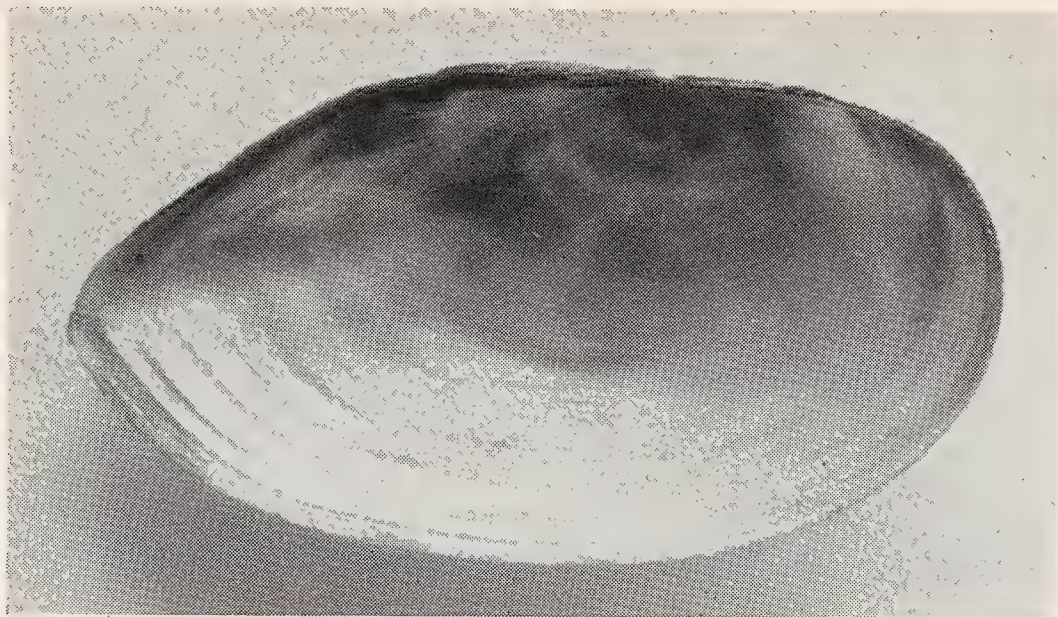
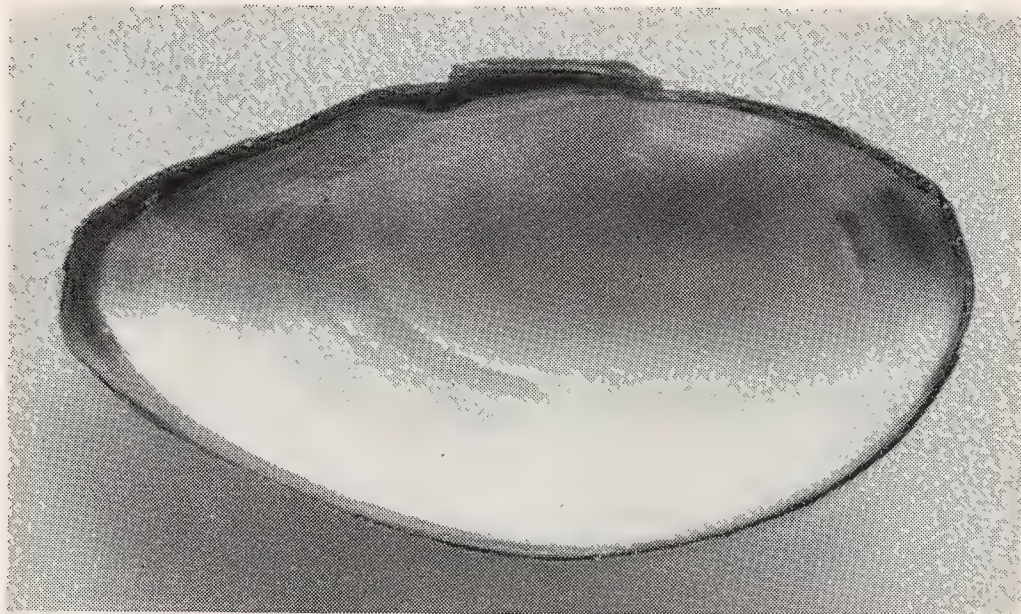
² *Pseudanodonta elongata* and *P. rothomagensis* both have an even thickness of shell similar to *cygnea*.

³ Antero-posterior measurement of shell in cm.

11. *cygnea*. $\times 1$.12. *anatina*. $\times 1$.

Figures 11 and 12 are examples of relatively young *cygnea* and *anatina* from Beam Brook that are thin-shelled and in outward appearance seem to be somewhat similar to each other, yet on scrutiny reveal much of their respective specific characteristics.

(7) **The inner surface of the shell.**—The concentric grooves found on the inner surface of *cygnea* are to some extent complementary to the series of concentric elevated growth lines seen on the outer surface ; the muscular scars are more or less indistinct, whilst the colour is generally a steely-blue to bluish-white ; in large shells it may be quite white. In *anatina* the concentric grooves usually are only faintly and partly shown, though a little more so in the posterior and, in a lesser degree, the ventral parts, and the muscular scars are

13. *cygnea*. $\times \cdot 53$.14. *anatina*. $\times \cdot 53$.

deeper and more clearly defined, especially in the anterior part: the colour is generally a milky white, this also being more evident in the anterior part; even in thin-shelled *anatina* the milky white appearance may be traced, although not nearly so distinctly.

Both *cygnea* and *anatina* are very variable shells, and an examination of the shape and ligament may at times seem inconclusive in identifying the species; then there is the difficulty in ascertaining the arrangement of the umbonal rugæ consequent on the erosion that the umbonal part of the shell is so frequently subject; furthermore there may be some hesitation in deciding from the condition of the inner surface of the shell; but whether or not these characters either separately or collectively fail to convince as to the specific rank of the mussel there is one test that the writer has found to be consistently reliable and that is the one of thickness as shown in cutting a section of one of the valves.

Notwithstanding what is above stated there are sometimes to be met with shells that appear to be abnormal, and it should also be remembered there is the possibility of hybridization having occurred ; neither of these cases is considered here.

The reproduced photographs illustrating this paper are from shells kindly sent to me at various times by P. Arnold, L. Haig, J. W. Jackson, C. Oldham, and A. S. Kennard, whom I also wish to thank for correspondence.

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CONTENTS.

	PAGE
Obituary Notice : R. J. Welch—Dr. J. W. JACKSON . . .	329
A Letter from George Humphrey to William Swainson, 1815—Dr. J. W. JACKSON . . .	332
Obituary Notice : J. D. Dean—COLIN MATHESON . . .	338
<i>Clausilia dubia</i> Drap.—R. H. MOSES . . .	339
Notes on <i>Potadoma graptaconus</i> P. & B.—G. C. SPENCE . . .	340
Orkney L. and F. W. Shells—J. R. le B. TOMLIN . . .	341
Infant Mortality of Mollusca—L. E. ADAMS . . .	341
Mollusca of the Iranian Plateau—H. E. J. BIGGS . . .	342
Enemies of the L. and F. W. Moll. of the British Isles— S. V. WILD and A. K. LAWSON . . .	351
<i>Nucella lapillus</i> L. at Knott End near Fleetwood—C. H. MOORE . . .	361
Notes on British Opisthobranchs, I : The Ecology of <i>Archidoris</i> <i>flammea</i> (A. and H.)—N. FISHER . . .	362
An Unusual Habitat of <i>H. caperata</i> —C. OLDHAM . . .	369
The Genus <i>Xymorus</i> Gebler—H. A. REHDER . . .	370
Proceedings : 13th Feb., 13th March, 3rd April, 8th May, 1937	370
Index . . .	373

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OBITUARY NOTICE :

ROBERT JOHN WELCH.

By J. WILFRID JACKSON, D.Sc., F.G.S.

(Read before the Society, 3rd April, 1937.)

THE death of Robert John Welch on 28th September, 1936, removed from our midst a charming personality and a man of many-sided activities and interests. He was an indefatigable worker, a mine of scientific knowledge, and a man who possessed the rare faculty of creating enthusiasm in others. In addition to many other pursuits he was a keen conchologist, specializing mainly in the land and freshwater shells. This side of his life merits some reference in this *Journal*.

Welch was born at Strabane, Co. Tyrone, on 22nd July, 1859. He was the second son of a family of eight. His father, David Welch, hailed from Kincardineshire; his mother from Tyrone. David Welch—the father—was a landscape photographer to the Lord-Lieutenant of Ireland, the first Duke of Abercorn. He died in 1875 at Bangor, whither he had come from Carlow to add Northern views to his already fine series of the scenery and antiquities of Southern Ireland. The father's talents and tastes for the study of natural history and for photography were inherited by Robert.

When only eight years old Welch had his first lessons in geology and marine zoology from his father among the fossiliferous shales and the famous purple urchin rock-pools at Bundoran. Educated first in private schools in Enniskillen and Newry, Welch later attended the Model School, Newry, where he was taught as extras various natural sciences, such as sound, light and heat, magnetism and electricity, and physiology, by the headmaster, Mr. Watt. At the same school he also had special lessons in water-colour painting in a small class under a Cork artist named O'Brien.

Soon after coming to Belfast in 1875 Welch joined the science classes taught by Robert Barklie, and obtained a number of Queen's prizes in such subjects as chemistry, magnetism and electricity, and

geology. He had thus every training for his life work. Before commencing a business of his own, in 1883, he worked as technical photographic assistant to E. T. Church of Donegal Place, Belfast. During his life he had many large industrial orders, and for many years was photographer to Harland and Wolff, Ltd., Shipbuilders, of Belfast, to the Board of Public Works, and to the Northern Irish Railways.

Welch joined the Belfast Naturalists' Field Club in 1880, and was an active member of the committee for some forty years. He was Honorary Secretary in 1908-1909, President in 1909-1910, and was elected an honorary member in 1922.

About 1893 Welch was asked by the then Keeper of the Dublin Museum, Dr. R. F. Scharff, to collect, where possible, non-marine mollusca and, later, isopods and leeches. It was this collecting that led to his specializing in the land and freshwater shells. At this early date he was brought into close contact with several English conchologists, and we find Robert Standen reporting in the *Irish Naturalist*, vol. iii, 1894 (p. 261) upon shells collected by Welch in Co. Donegal. Later, in July, 1895, during the joint excursion of the Irish Field Clubs to Galway, Welch greatly assisted R. Standen and E. Collier in the study of the mollusca of that region (see reports by Standen in *Irish Naturalist*, vol. 4, 1895, pp. 264-270).

Welch became a member of the Conchological Society in September, 1895, being introduced by Robert Standen and Edward Collier. He was elected a member of the Council in October, 1898, being the first representative for Ireland, and again served on the Council in later years. In October, 1922, he was made President, and his Address given at the Annual Meeting in Manchester in October, 1923, was listened to with very great interest. His subject was "Some differences between the British and Irish Non-Marine Mollusca and their Habitats", and this was illustrated by some sixty of his superb slides. The Address was never written up for publication, very much to the regret of the members. Though a member of the Society for over forty years, he contributed little to the *Journal* but left the writing of reports to others. He was a frequent attendant at the Annual Meetings and invariably brought much Irish material for exhibition and distribution among his friends. His cheery presence was always welcome, and the members lingered long after the meetings to listen to his entrancing talks about his collecting experiences and other matters. When in England he usually stayed with Standen and his visits were always combined with trips to Derbyshire and other places in search of shells or for the purpose of adding photographs to his lantern-slides and view series. Through contact with Standen and others Welch had his attention drawn to

the accumulations of small shells collected by the wind into hollows in the sand-dunes in various places. Later he became a specialist in the study of these "shell-pockets" and collected quantities of material for his numerous friends (see papers by Welch in *Irish Naturalist*, vol. 7, 1898, and *Journal of Conchology*, vol. 10, 1903). Some idea of his work in this direction may be gathered from Kennard and Woodward's exhaustive report on the "Post-Pliocene Non-marine Mollusca of Ireland", published in 1917.

In 1900 Welch was appointed photographer in natural history and archæology to Queen Victoria. In 1905 he was elected a life member of the Royal Irish Academy, mainly for his scientific photo-survey work.

From February, 1911, to December, 1915, Welch was joint-editor of the *Irish Naturalist*, and again acted in that capacity from June, 1922, to the cessation of that magazine in December, 1924. He contributed numerous notes and papers on a variety of subjects to its pages. These are noted in the indices, vols. 1 to 25, in vol. 25, 1916, and vols. 26 to 33, in vol. 33, 1924. Several of the notes deal with Irish mollusca, and one is of particular interest in recording *Bythinia leachii* Sheppard for the first time in Ireland (see *Irish Naturalist*, vol. 17, 1908). In addition to the foregoing Welch made the first discovery of Irish examples of another freshwater species, *Hydrobia jenkinsi* Smith, in 1893, near the mouth of the River Bann, Co. Derry. These were recorded by that veteran conchologist, Lionel E. Adams, in 1898 (see *Irish Naturalist*, vol. 6, 1898, p. 234).

In 1925 Welch received the honorary degree of Master of Science from Queen's University, Belfast. In presenting the candidate to the Marquess of Londonderry, K.G., Chancellor of the University, Professor Gregg Wilson said: "I have the honour of presenting to you for the degree of Master of Science (*honoris causa*) Mr. Robert J. Welch, M.R.I.A., Past-President of the Conchological Society of Great Britain, and one of the editors of the *Irish Naturalist*. Mr. Welch has many claims for such an honour. He has contributed largely to the advancement of our knowledge of archæology, geology, botany, and zoology. He is an acknowledged master in the domain of scientific photography, and his name is known all over the world in connection with the illustration of natural phenomena. He has taken a prominent part in several biological surveys, and in particular in the exhaustive exploration of Lambay Island and Clare Island, undertaken by the Fauna and Flora Committee of the Royal Irish Academy. He has published valuable natural history papers—chiefly on Land and Freshwater Mollusca—in the *Irish Naturalist*, the *Journal of Conchology*, the *Proceedings of the Royal Irish Academy*, and the *Proceedings of the Belfast Naturalists' Field Club*.

But perhaps even more remarkable than the influence he has exerted by his publications has been the stimulus he has given by his enthusiasm to those whom he has personally guided in the pursuit of scientific knowledge. He has inspired by his own zeal many surveying parties of workers from our own neighbourhood and from England and elsewhere; and he has helped to make famous the best collecting grounds of Ulster. He has been unsparing in his efforts to train the young naturalists of Belfast, so that the cherished reputation of our city for field work may be maintained. No naturalist was ever more unselfish in his work. As an example of his generosity I may mention that he has to his credit the fact that he has collected and presented to the museums of Great Britain and Ireland approximately one million shells. For all these reasons I have pleasure in asking you to confer the degree of Master of Science."

In 1927 Welch was awarded the first civil pension granted by the Government of Northern Ireland.

The Conchological Society was represented at his funeral by Miss Nora Fisher and Mr. Ranald Macdonald. Like many others, both these young naturalists are indebted to Welch for much kindly advice and guidance. They were present along with Mr. and Mrs. A. H. Davison, of Belfast, and myself at Welch's last natural history excursion to Portstewart, Co. Derry, in September, 1935.

Further tributes to Welch will be found in the Memorial Number of the *Irish Naturalists' Journal*, vol. 6, November, 1936.

A LETTER FROM GEORGE HUMPHREY TO WILLIAM SWAINSON, 1815.

By J. WILFRID JACKSON, D.Sc., F.G.S.

THE following letter was, with an incomplete copy of Humphrey and Da Costa's *Natural History of Shells*, 1770, presented to the Manchester Museum by Dr. W. H. Dobie, of Chester, shortly before his death. A small collection of shells, said to be part of the Swainson Collection, was also donated. It is stated in one of Dr. Dobie's letters that the book and shell collection came to him from Mr. Swainson's daughter, a Mrs. Longueville,¹ in 1868. The book contains twelve coloured plates (i to xii), two pages of preface (i to ii), and twenty-four pages of text (3 to 26), in English and French, describing plate i to plate v, fig. 2 (part only). There is

¹ Mrs. Longueville, of the Parsonage at Hoylake, Wirral, is mentioned in the preface and pages 47 and 51 of Hume's *Ancient Meols*, 1863, as having a collection of antiquities from the Wirral coast.

no title-page. It is bound in half-morocco and lettered on the back "Humphrey's Patella, etc." As to the authorship of this work I would refer readers to the notes by T. Iredale, in *Proc. Malac. Soc.*, vol. xi, 1915, pp. 307-9. In Iredale's opinion, Da Costa was the author. The latter refers many times to the "Anonymous Conchology" in his "Historia naturalis Testaceorum Britanniae", 1778 (see pp. 1-24), but certain comments in the following letter suggest Humphrey as the author. He speaks of "the *Patella* published by me", and refers to several misidentifications by Da Costa (=D.C.), presumably in the latter's "Hist. nat. Test. Brit.", 1778. Perhaps they started the thing together and fell out later.

With regard to the shell collection donated with the book, a few of the specimens bear stuck-on labels with printed numbers which agree with those in the "Museum Calonnianum", 1797. There are also occasional tickets in Humphrey's handwriting giving the name of the species, the locality, and reference to the "Museum Calonnianum", such as "*Pectunculus nodulosus* S. M.C. 897. Warty Clam. E. Indies."

The letter is as follows :—

"Dear Sir,

On Saturday I sent to the George and the Blue Boar Inn, in Holborn, a small box, directed to you, at the Custom House, Liverpool. Understanding that the coach went off about five in the afternoon, I sent it at four o'clock, which proved too late as the coach set off at three. It was therefore left to go by the coach next day, and before this reaches you I hope it will have arrived safe. I hope to hear that you, Mrs. Swainson, Mr. Commissary, and Miss S. have all reached Home in safety. You just set off in time to get down before the Frost took place. In respect to the *Patella* published by me, I inform you as follows.

- Pl. 1, fig. 5. Umbrella Limpet, add the Country Amboyna.
 „ „ 6. Painted Net. Country W. Indies.
 „ „ 8. Black Limpet. Country Guinea.
 „ „ 9. Zebra Limpet. Country E. Indies only.
 „ „ 10. *Kermes*. I have lately discovered that this is the Upper Valve of *Anomia craniolaris* Linn. But I cannot think it belongs to that Genus, having neither perforation nor internal structure. It rather belongs to the *Ostreæ*, the Under or Inner Valve being constantly attached to the Rock, whereas the *Anomia* never adhere by their shells. I received mine from Elbe, attached to Coral.
 „ „ 11. I call this, not "*Balano patella*", but *parasitica* from its being found on, and eating into other shells. Comes also from the S. Sea.
 Pl. 2, fig. 2. Is a Bivalve Shell. Solander places it with the *Mytili*, but Rumphius says it lives under the sea sand, which the Mussels do not. I think it of a new Genus.
 „ „ 3. *Scabrosa*. Rough. Country Mediterranean. Da Costa has omitted this in his Description.
 „ „ 4. This is *Patella granatina* Linn. not *granularis* which name appertains to Pl. 3, fig. 13, and D C. quotes the last name for that.

- Pl. 2, fig. 5. The lower figure is the papyrace of Davila, and I am inclined to think it a distinct species. It came from Cape Horn. The upper figure 5 is the 'Bronze', and comes from Falkland Isles. The Conic one D C. mentions, is a distinct kind, which I call the Conic Bronze. It is sometimes radiated, which the other Bronzes never are.
- „ „ 6. *Patella petasus*. Mus. Calonn. 52.
- „ „ 7. Is not a Limpet but a Scoop. See Note at M C. 59. The country is Peru and Chili.
- „ „ 8. The 'Beauty'. 'Tis the red ones are the faded shells, the grey brown are the perfect ones. M C. 29.
- „ „ 10. The brown striated of the Cape.
- „ „ 12. The Hand Limpet.
- Pl. 3, fig. 2. The brown Star, from the Cape of Good Hope. Not the W. Indies.
- „ „ 3. The mottled white Limpet. W. Indies.
- „ „ 4. The small E. India *Auricula*.
- „ „ 5. The Endive Limpet. It is a species tho' D C. doubts it.
- „ „ 6 & 15. Are different varieties of the little pied or protheus Limpet of the W. Indies. Very common. *Patella protea*.
- „ „ 9. The Mussel Limpet. Falkland Isles.
- „ „ 10. The middle figure is a red variety of *Pat. vulgaris*. The other two are the Marygold. The European *Auricula* is another species. The Marygold is from the Coast of Barbary. D C. confounds it with the Common Limpet and European *Auricula*.
- „ „ 13. *Patella granularis*. The Granulated Limpet of the Cape. How D C. came to call it the Thorny I can't conjecture.
- „ „ 14. The nine-rayed W. India Limpet.
- Pl. 4, fig. 2. The long W. India cracked Limpet, which D C. confounds with the English and other species. I never saw any from Falkland Isles but a very small one, which is perforated at top, like the English fissurated Mask, and is figured pl. 7, fig. 8.
- „ „ 3. The red rayed fissurated Limpet, from the E. Indies. There are 10 or 12 species of these Cracked Limpets.
- „ „ 4.4. The upper the blue rayed, the lower the horny Limpet. D C. puts them as one, but they are distinct and inhabit different places.
- „ „ 6. Should have been called the foliated.
- „ „ 1, 7 & 8. I know nothing of.
- „ „ 12. The Humming Bird. Cape of Good Hope.
- „ „ 14. The Lady's Cap. W. Indies. Not from the Mediterranean same as pl. 1, fig. 14.
- „ „ 17. A bad figure. *Catillus fluviatilis*. Montagu says is almost the only shell found to inhabit rapid Rivers and Torrents. It has been found on the Starlings of London Bridge. H.
- „ „ 19. Mr. Lyonet had two, one of which he gave to M. de Calonne. See M C. 84.
- Pl. 5, fig. 1. The Wheatsheaf. E. Indies.
- „ „ 3. Plumose. E. Indies.
- „ „ 4. Shirt Button. W. Indies.
- „ „ 5. Umbrella, same as pl. 1, fig. 5, but a better figure.
- „ „ 6. Little Hairy. W. Indies.
- „ „ 7. Lapland Cap. W. Indies.
- „ „ 8. Magpie. S. Sea?
- „ „ 9. Done from that which was in the Portland Cabinet, which was much better than the one figured pl. 2, fig. 7, but is not a Limpet.

- Pl. 5, fig. 10. Brown Auricula. Mediterranean.
 „ „ 11. Duck's Bill. Amboyna. Now much larger from New S. Wales.
 „ „ 12. Minute Beaked Limpet. Rimini. See Gualtieri, from which this is copied.
 „ „ 14. Changeable Limpet. Barbary.
 „ „ 13. Radiated. E. Indies.
 „ „ 15. Monk's Cowl. Gallapagos. Done from the Portland one, brought by Sr. Fr. Drake.
 „ „ 16. Smooth pied Limpet. From the Portland Cabinet. Unknown whence. Supposed E.I.
 „ „ 17. Striated White. E. Indies.
 „ „ 18. Green Hair-streak. Portland Cabinet. Unknown whence.
 „ „ 19. Radiated. M C. 41. Cape G. Hope.
 „ „ 20. Reticulated. Supposed E.I.

- Pl. 6, fig. 1. Echinated *Crypta*. W.I.
 „ „ 2. Ridged *Galerus*. E.I.
 „ „ 3. White oval Slipper. E.I.
 „ „ 4. *Catillus numidica*. E.I. M C. 1052.
 „ „ 5. *Crypta maculata*. M C. 68.
 „ „ 6. *Calyptra corrugata*. M C. 71. W.I.
 „ „ 7. *Crypta punctata*. Florida.
 „ „ 8. *Calyptra striata*. E. Indies.
 „ „ 9. „ *foliacea*. Amboyna.
 „ „ 10. „ *sulcata*. E.I.
 „ „ 11. *Galerus*. E.I.
 „ „ 12. „ *sulcatus*. Tinian I.
 „ „ 13. *Crypta nautarum*. M C. 69. N. America.

- Pl. 7, fig. 1. Great-hole Mask. Cape of G. Hope.
 „ „ 2. Curved Mask. English.
 „ „ 3. *Larva machroschima*. M C. 62.
 „ „ 4. „ *nimbosa*. M C. 63. W.I.
 „ „ 5. „ *radiata*. M C. 66. Falkland I.
 „ „ 6. „ *viridis*. Green. W. Indies.
 „ „ 7. „ *tuberculata*. M C. 64. W.I.
 „ „ 8. „ *fissurata*. Falkland Isles.
 „ „ 9. „ *cancellata*. M C. 65. W.I.
 „ „ 10. „ Mottled. W.I.
 „ „ 11. „ *rubra*. Red (key-hole) Mask. W.I.
 „ „ 12. „ *truncata*. Cut (key-hole) Mask. W.I.
 „ „ 13. „ Little black rayed M. W.I.
 „ „ 14. „ Little green rayed M. W.I.
 „ „ 15. „ *reticulata*. Thin netted. W.I.
 „ „ 16. „ Rayed Mask. Mediterranean.
 „ „ 17. „ W. Indies.

- Pl. 8, figs. 1, 7, 12, 13. *Haliotis vulgata*. M C. 324.
 „ „ 2, 3, 4, 5, 8, 9. *H. rugosa*. M C. 323.
 „ „ 10, 11. *Hal. lævis*. Smooth. Mediterranean.
 „ „ 6. *Hal. patula*. Broad Ear. China. Uncoated.
 I had not a complete one to engrave from when this plate was done.

- Pl. 9, figs. 1, 2. *Hal. gracilis*. M C. 326.
 „ „ 3. *Hal. striata*. M C. 322.
 „ „ 4. „ *carinata*. Keeled. M C. 320.
 „ „ 5. „ *pulchra*. Beauty. Commodore Byron's
 K. George's Island, S. Sea.
 „ „ 6. „ *tuberculata*. M C. 321.
 „ „ 7. „ *corrugata*. M C. 327.

- Pl. 10, fig. 1, 2. *Oscillum lignaria*. Wood-piercing Worm.

- Pl. 10, fig. 3. *Oscillum lignaria*. to shew the semi-chambered structure.
- „ „ 4. „ Wood pierced by ditto. *Teredo navalis* Linn.
- „ „ 5, 6. *Serpula fuscata*. Brown spiral oriental Worm.
- „ „ 7, 8. „ *spiralis*. M C. 4.
- „ „ 9. „ *cochlearia*. M C. 5.
- „ „ 11, 13. „ *lumbricalis*. M C. 15. *Vermicularis* of Pennant & Ellis.
- „ „ 12. „ *tubularia*. Montagu 14. *Intricata* Pennant, who refers to his fig. Tab. 91, 157 instead of 158. 157 is *triquetra*.
- „ „ 14. *Serpula*.
- „ „ 15, 16. *Serpula cancellata*. Brown chequered. W. Indies.
- „ „ 17. *Serpula*.
- „ „ 18, 19. *Serpula filaris*. Thread Worm. Europe.
- Pl. 11, fig. 1, 2, 4. *Caduceum echinata*. E. Indies. 4 is the best figure. The colour of all should have been dark violet. 1 and 2 done from bad ones.
- „ „ 3. *Caduceum rosea*. Rose coloured fissurated Worm, or Rod. Coast of Guinea.
- „ „ 4 a or Upper fig. 4. *Serpula contorta*. Great twisted Worm. Supposed E.I. Unique from Mus. Portland.
- „ „ 5. *Oscillum gigantea*. Sumatra, Amboyna, etc. Fig. copied from Rumphius, but he is wrong in dividing into two branches, and it should have terminated where the fork begins. The truth is, this species has two channels, which proceed from the narrow end, or mouth, a little way down the shell, and from which channels proceed the tentaculi which branch out from the shell. They inhabit in swamps, buried in the mud, all but the mouth. Some are 5 ft. 10.
- „ „ 6. *Serpula spirorbis*. Montagu 1.
- „ „ 7. *Serpula*.
- „ „ 8, 9, 10. *Serpula*. Rugose ridged Worm. W.I.
- „ „ 11. *Serpula*.
- „ „ 12. *Serpula*.
- „ „ 13. *Serpula parasitica*. Parasite Worm. W.I.
- „ „ 14, 15. *Serpula*. A kind of parasite Worm imbedding or eating into shells. E.I. The lower one is on a Clamp shell.
- „ „ 16. *Serpula serrata*. Saw-edged. On the bottom of the inside of a Balanus. Coast of Guinea.
- „ „ 17. „ *violacea*. Violet Worm. E. Indies.
- Pl. 12, fig. 1. *Dentalium ventricosum*. Bellied. E.I. *D. gadus* Montagu 3. Hakes teeth of Mariners.
- „ „ 2. „ *elephantinum*. Elephant Tusk.
- „ „ 3-8. „
- „ „ 9. „ *rubrum*. Red striated. Minorca.
- „ „ 10. „ *album*. White fluted. E. Indies. M C. 16.
- „ „ 11. „ *striatum*. Green striated. M C. 17.
- „ „ 12. „ *sulcatum*. Green fluted. M C. 18.
- „ „ 13. „ Lobster's Horn, fossil, France.
- „ „ 14. *Harpagium*. Unfurbelowed Watering-pot. M C. 12.
- „ „ 15. „ Furbelowed Watering-pot. M C. 13.
- „ „ 16, 17, 18. *Lituus spiralis*. M C. 76.

Pl. 12, figs. 19 to 27.

Different kinds of *Orthoceratitæ* or Straight Nautili, copied from Gualtieri, found on the sea shores near Remini. See also *Planeus* and *Breynius*.

I have gone through the different plates as well as I could at present. The *Serpulæ* and *Dentalia* are not sufficiently known, and I have not been able as yet to define the species. The remarks on the four first plates you will find necessary.

The Box and this Letter have been retarded by the unhappy circumstance of Mr. Lochee's Death, of the dreadful circumstances attending which you have no doubt been informed by the public Prints, and which so disconcerted us for some days that we could think of nothing else. I had occasion to consult him about a sale I have to come on in a short time, and went to him on Tuesday. I found him in bed, but he appeared very cheery, said he should be in the room next day, and that he only kept his bed from having taken a second dose of James's powders. On Thursday I sent some goods, but my son brought them back, as the Clerk he said refused to admit them, as Mr. Lochee he said was dead. You may guess our surprise on the occasion. Owing to our confusion your *Pectunculus aculeatus* M C. 894 was forgot to be packed up with the rest. I shall send it you the first opportunity. With all our best respects to you, Mrs S., Mr William, Miss Eliza and the rest of your good family, I remain,

Dear Sir,

Your obliged & m. ob. serv.

GEORGE HUMPHREY.

LONDON. Tuesday.

12th Dec. 1815.

This letter is but single & the Post Office return for a Cover that is not written on within."

The M C. in above letter is Museum Calonnianum, published in 1797. The copy of this work in the Manchester Museum has the following inscription, in ink, under the headline of the title-page—"drawn up by Mr. Humphrey." The handwriting is old. The following alterations in the same handwriting also occur: p. 5, Genus VIII, *Pedum* is altered to *Lituus*; p. 22, Genus XXX, *Auris Mustelæ* is altered to *Myosota*; p. 53, Genus XXI, *Lacinia* is altered to *Gryphus*, and "Beaked or" is added to *Furbelowed*; p. 62, Genus V, *Lituus* is deleted.

Gryphus Megerle von Muhlfieldt 1811 (non Humphrey) is now the recognized name for the brachiopod genus *Liothyrina* Oehlert, 1887, the genotype of which is *Anomia vitrea* Born., 1778.

The *Kermes* of the above letter (pl. i, fig. 10, of the *Nat. Hist. of Shells*) belongs also to the Brachiopoda, and to the genus *Crania* in particular. Whether the name is valid is doubtful.

The fig. 2 of plate ii of the above work is that of the brachiopod *Lingula*, i.e. *lingua* (Sol.), 1786. The specimen is said to be in the British Museum, No. 3715.

OBITUARY NOTICE :

J. DAVY DEAN, F.R.E.S.

By COLIN MATHESON, M.A., B.Sc.

(*Read before the Society, 3rd April, 1937.*)

CONCHOLOGY has suffered a severe loss by the death, on 27th January, at his home, Heathwaite, Heath Park Avenue, Cardiff, of J. Davy Dean. The son of Thomas Dean, a linen-draper, of Manchester, he was born in that city on the 30th of October, 1876. From his earliest years he had a strong artistic bent, which determined him in the choice of his original profession and also led him, through an appreciation of their beauty, to the study of the shells of molluscs. He received his early education at the Manchester Grammar School, and from there, having won one of three scholarships offered, he passed to the Manchester School of Art.

On the completion of his training, he was engaged for many years as a designer in stained glass in Manchester and Lancaster. During this period he was also actively prosecuting his conchological activities ; he became a member of the Conchological Society as far back as 1897, and for forty years thereafter he was a regular contributor to this *Journal*. Between thirty and forty papers and notes, mostly under his own name and one or two in collaboration with others, appeared in the *Journal* over this period, several of them dealing with the Clausiliidæ, a family which he made peculiarly his own.

The year 1915, when he came to Cardiff, marked an important changing-point in his career. He came there to follow his original profession, but soon the late Dr. W. Evans Hoyle, director of the National Museum of Wales, engaged him to arrange the shell collections in that institution. In 1918 Dean was appointed Assistant Keeper in the Department of Zoology, a post which he held till his death. In the same year he married Miss H. Lillian Tassell, daughter of W. H. Tassell, of Newport, Mon. There were two children of the marriage, both of whom, with his wife, survive him.

In his new post, though the Mollusca continued to be his principal interest, Dean was also occupied with other branches of natural history. He was responsible, in 1926, for the preparation of a *Guide* to the Griffith and Vivian Lepidoptera, two large and comprehensive series of Lepidoptera in the Museum collections ; while a paper by him entitled "An Analysis of certain Records relative to the Migration of *Agrius* (= *Sphinx*) *convolvuli* Linné", in the *Entomologist's Monthly Magazine*, 1931, was recognized as a valuable

contribution to the study of insect-migration, a subject which at the present time is receiving a greatly increased degree of attention.

His artistic abilities also found an outlet in the arrangement of various exhibits in the Museum; in this connection the writer would especially acknowledge the work done by him in painting the background for a large habitat group in the zoological galleries, depicting "Wild Life in Early Wales".

His election to the Chair of the Conchological Society for the session 1934-5 was a fitting recognition of many years of useful work; his Presidential Address embodied a large amount of painstaking investigation on "Conchological Cabinets of the Last Century". Printed in Vol. 20 of the *Journal*, it formed his last contribution to that publication, though it is hoped that it will be possible to prepare for publication a considerable quantity of data which he had subsequently accumulated on the same subject.

Dean's work was concerned with many aspects of the Mollusca, with the ecology of the living animal as well as with conchology; one of his earlier papers, in collaboration with Rankin and Kendall, dealt with the ecology of the Cheshire land Mollusca, while his last paper, published only a few months before his death in the first volume of a comprehensive *County History of Glamorgan*, treated, on ecological as well as systematic lines, of the land and freshwater Mollusca of the county.

Throughout his career he retained his interest in art; he often exhibited in water-colours and oils at Manchester, while in Cardiff he was for many years an active member of the Committee of the South Wales Art Society and exhibited at their annual exhibitions.

The writer, who was in close contact with Dean for fifteen years, shares with many the deep regret felt at his passing. He combined with indefatigable industry an unvarying cheerfulness and good nature which remained unimpaired till the last.

Clausilia dubia Drap.—When living in Dover between 1900 and 1905 I discovered a colony of *dubia* on the chalky slopes of the Castle Hill, situated on the right-hand side of the Deal Road and about two-thirds of the way up. The shells were near the Castle walls and plentiful, together with *C. laminata* and *C. rugosa*. On revisiting Dover in August, 1936, I was unable to find a single specimen, although I hunted carefully over the old ground, which, however, has been tidied up by the authorities, and in place of the rough rank herbage is mostly covered with short grass. The shells may, of course, have migrated, owing to being disturbed, to some other part of the slopes which are extensive and cover several acres.—R. H. MOSES. (Read before the Society, 13th March, 1937.)

NOTES ON POTADOMA GRAPTOCONUS, PILS. & BEQ.

By GEO. C. SPENCE.

(Read before the Society, 9th January, 1937.)

A SERIES of some sixty of above *Potadoma* has been submitted to me by Herr Schlesch, collected in October, 1931, by the Rev. A. Unsgaard from a river 50 kilometres south of Indo-Sibiti, French Congo. The shells comprise seventeen in live condition, twelve dead but good, and the remainder very dead or merely broken fragments. The figured type¹ is decollate, retains five whorls, and measures 33 mm. by 15.3 mm. A complete adult before me terminates in an acute apex, consists of eleven whorls, and measures 33 by 13 mm. The nepionic portion has the initial whorl intorted, is smooth, whitish, with a brown zone developing on the upper portion of the second whorl, which zone widens progressively, so that on the fourth whorl the light streak has disappeared. The operculum is paucispiral as described and figured in the case of *Potadoma liricineta walikalensis* P. & B.²

In the above locality the shells do not appear to suffer severely from erosion. The live ones are but slightly affected, and that only at the extreme apex. Dead shells are also well covered, and it is only in the case of the very dead that the shell substance is crumbling, with the epidermis in ribbons or entirely gone. In two examples only has sufficient of the apex disappeared to compel the animal to plug the resultant aperture. Many have a roughly circular hole at the back of the last whorl. An examination of the broken edges shows that the injury was not caused at the time of collection, but some time previously, and was, I should judge, caused by chemical erosion. The injury is not necessarily fatal, as in one case the damage has been repaired.

¹ Pilsbry and Bequaert, *Aquatic Mollusks of the Belgian Congo*, pl. xx, fig. 10.

² Ibid., p. 272, fig. 45b.

ORKNEY LAND AND FRESHWATER SHELLS.

By J. R. LE B. TOMLIN.

(Read before the Society, 13th February, 1937.)

THE following island records are the result of desultory collecting in the Orkneys in the summers of 1935 and of 1936.

Land and freshwater shells are scarce there and want a good deal of finding. Until quite recently they were in the happy condition of lacking even *Helix aspersa*, but that traveller managed to gain unobserved entry a few years ago attached to Norwegian timber, and now occurs in some of the Kirkwall gardens.

PAPA WESTRAY.—I saw *Arion hortensis* and *A. circumscriptus* several times last July in the garden of Holland.

WESTRAY.—*Lauria cylindracea* and *Vitrina pellucida*, both moderately common on the links at the back of Pierowall in sandy hollows which are dug to hold seaweed.

HOY.—*Arion hortensis* in cultivated ground; *Succinea pfeifferi*, *Lymnæa truncatula* and *Retinella radiatula* sparingly on more or less marshy heather ground.

MAINLAND.—*Sphærium corneum*, *Theodoxus fluviatilis*, *Hydrobia jenkinsi*, and *Lymnæa peregra* in Loch of Harray, near the Standing Stones; *Arion hortensis*, *A. circumscriptus*, *Agriolimax agrestis*, *Milax gagates*, *Oxychilus alliarius*, *Lauria cylindracea*, all fairly common at the foot of Black Craig, on the Stromness side; *Pupilla muscorum* scarce on herbage on the shore between the above locality and Stromness.

For other notes on some of the above, see this *Journal*, Vol. XX, pp. 199 and 273.

Infant Mortality of Mollusca.—Professor A. E. Boycott in his masterly paper ¹ on “The Habitats of Freshwater Mollusca in Britain”, says: “In nature there is an immense ‘infant mortality’.” A recent example of this may be worth recording. I had been keeping under observation a male and two female Palmated Newts in my aquarium, and at the end of May several tadpoles appeared. There were also in the aquarium several *Lymnæa peregra*, the offspring of which thickly besprinkled the glass sides. Early in July I noticed the tadpoles eating the young *peregra* off the glass, and from two to four young shells could be clearly seen in the translucent bodies of the tadpoles. Before the end of July not a single young *peregra* was left. If I had not taken the precaution of removing the adult newts on the arrival of the tadpoles probably they too would have disappeared. Seven or eight young frog-tadpoles put into the aquarium with the adult newts disappeared in a few days. These happenings were, of course, not in natural conditions, but they serve to show what is likely to happen to the common inhabitants of a pond.—LIONEL E. ADAMS. (Read before the Society, 10th October, 1936.)

¹ *Journal of Animal Ecology*, May, 1936.

MOLLUSCA OF THE IRANIAN PLATEAU.

By H. E. J. BIGGS.

THE Iranian Plateau is poor in mollusca. The following notes are the result of collecting during the years 1922-8 and 1931-5, mostly in localities over 4,000 feet in the dry deserts and mountains. Some areas have been worked fairly well, such as the districts of Kerman and Isfahan, but the most interesting species were found while travelling by car or caravan, when a halt has given time for search.

The following list will, I think, show that the fauna is distinctly Palæarctic. Unfortunately I have not been able to visit Persian Baluchistan. A few freshwater mollusca were given me by an Iranian friend who had seen military service on the border, and notes are included below. More collecting in this area would show how far the Oriental influence extends into Iran if at all.

Isolation tends to make species vary and we see this very clearly in the case of *Melanopsis doriae* Issel: some of the named species may, on further investigation, turn out to be only local variations of well-known Palæarctic species. The Iranians have a method of irrigation peculiar to them, namely by "*qanats*". These are made by digging a series of wells from the mountains where water is found, to the middle of the plain where water is required, and then connecting the bottoms so as to form an underground canal. These *qanats* are only a few feet wide. Water is thus conserved, little being lost by evaporation. There is normally no connection between these water systems and any other. In July, 1932, heavy rain fell in Kerman causing floods. Many of these *qanats* were destroyed by surface water carrying sand down into them and filling them up. Thus a *qanat* at Jelalabad, where *M. doriae* was always to be found in abundance, was wiped out. When I left in November, 1935, this had not been cleared. If it is ever reopened, as it may be should money be forthcoming, it will be interesting to see if it again supports a molluscan fauna, and to speculate as to its origin. As the main road into Kerman crosses the open end of the *qanat* it should be easy for any untrained observer to look out for the coming of new life.

In the mountains isolated ponds occur and in one a very large form of *L. truncatula* Müller was the only species found.

1. *Agriolimax* sp.

Ten specimens found under stones in a damp grassy patch at Deh Bala, west of Yezd, 9,000 feet. Slugs are rare on the plateau and I have only found them in one other place, the oak forests

near Shiraz amongst dead leaves of *Quercus persicus* J. and S. The two specimens taken there decomposed before I could get spirit.

2. **Parmacella** sp.

Three dead shells in rock crevices at Pul-i-Agineh, south of Karzerun, 3,000 feet. *P. olivieri* Cuv. occurs near Resht on the Caspian coast.

3. **Vitrina (Oligolimax) annularis** Stüder var. **persica** Bttg.

Zool. Jahrb., iv, p. 935, pl. xxvi, f. 4 a-c, 1890.

A fairly common shell at Seguch, 30 miles east of Kerman at 9,000 feet; at Deh Bala at 9,500 feet, and on the lower slopes of Shir Kuh (near Yezd) at 10,500 feet. It occurs in débris round the roots of bushes and under stones in damp places. The variety was described by Boettger from specimens collected at Shahrud in the north of Iran.

4. **Monacha syriaca** Ehrbg.

Helix syriaca Ehrenberg. *Symb. Phys. Moll.*, i, No. 8, 1831.

A few dead shells taken under bushes at Jaru, 49°31' E. by 31°33' N., at 1,326 feet. This species does not occur higher up on the plateau.

5. **Monacha iranica** sp. nov.

Shell subglobose, irregularly striate, somewhat malleate on body whorl, narrowly umbilicate, translucent, horn-coloured, dull; mouth three-fourths of a circle, oblique, margin sharp with strong submarginal rib; rather faint peripheral cream band; suture somewhat depressed, spire slightly depressed; $5\frac{1}{2}$ –6 whorls.

Holotype.—Alt., 9 mm.; diam., 13 mm. (in my collection).

Average for eleven paratypes: Alt., 8.6 mm.; diam., 12.2 mm.

The type locality for this species is the banks of the Zeyandeh Rud at Isfahan, but it is also common in gardens and other well-watered places in the neighbourhood. A form which is generally a little smaller and thicker occurs at Bagh-i-Garvart near Isfahan.

6. **Helicella millepunctata** Bttg.

Zool. Jahrb., iv, p. 948, pl. xxvii, f. 13 a-c, 1890.

The commonest land mollusc on the plateau. It occurs in gardens at Isfahan, Kerman, Seguch, Deh Bala, Dilijan, Shahdad (Khabis), and Bam. The species varies in size, of 165 specimens measured the largest had diam. 16.8 mm. $\times$ alt. 11.6 mm., and the smallest, 10 mm. $\times$ 6.4 mm. The average ratio diam./alt. is about 1.5, but conoid forms with a ratio 1.37 have been taken, while depressed forms with a ratio as high as 1.74 are not uncommon. Boettger

described the species from Shahrud. Amongst the hundreds which have passed through my hands several varieties have been found.

(a) var. **depressa** nov.—Shell as type but depressed spire and having a ratio diam./alt. more than 1.65.

(b) var. **castaneoradiata** nov.—Shell small, with dark brown markings from the suture to near the peripheral band. Six specimens taken from Bagh-i-Shahzded near Kerman.

(c) var. **hyalopunctata** nov.—Shell pure white, punctuations and peripheral band transparent. Isfahan, November, 1926.

One scalariform specimen taken in a garden at Isfahan in 1934.

The holotype of each of these varieties is in my collection.

H. millepunctata seems able to stand a great deal of heat and on very hot days in summer may be found securely fastened to the fruit trees in gardens up to 6 or 7 feet from the ground, but usually lower. At the beginning of the wet season it can always be found depositing eggs in crevices in damp ground, i.e. during November, but as early as October if the rains have started.

7. **Helicella derbentina** Kryn.

Bull. Soc. Nat. Moscou, ix, p. 192, 1836.

A few specimens found æstivating on a thorny bush near a stream by the road between Arabkafer and Gazeen at about 1,000 feet. These two places lie on the old caravan route from Mohammerah to Isfahan and the shells were taken about midday when I had dismounted from my mule and was walking off the beaten track.

8. **Helicella (Candidula)** sp.

A number of shells found under stones on the Dukhtar Pass, west of Shiraz, at about 4,000 feet. This is the only spot where I have found this, as yet, undetermined shell. The radiator of the old lorry in which I was travelling up this very steep pass boiled and the cap blew off. This delay of about a quarter of an hour gave me time to collect three fresh species of shells, many beetles and a few plants.

9. **Jacosta tuberculosa** Conrad.

Carocolla tuberculosa. Lynch, *Office Rept. U.S. Exp. Dead Sea*, p. 229, pl. xxii, fig. 129. 1825.

Between the British Residency at Sabzabad, near Bushire, and the seashore is some flat arable land. Under stones, which are exposed to the hot sun, this species was found in dozens sealed fast to the stones, sometimes in masses, and to one another. They were in all stages of growth (7th May, 1935).

10. **Ena (Subzebrina) oxiana** (Mts.) var. **schahrudensis** Bttg.

Bulimus (Petræus) oxiana, Marts. 1876, var. *schahrudensis*.
Boettger, *Zool. Jahrb.*, iv, p. 954, pl. xxvi, f. 15 a-c, 1890.

Abundant under stones and in débris in the clefts in the rocks near Seguch. I only took this species in one place, a ridge of slaty rock running north and south, and about a mile and a half due north of Seguch village. It occurs only at about 7,500 feet; lower down exactly similar habitats were examined but no trace found. On the opposite side of the valley at about the same height on the lower slopes of Jupar Mt. dead shells of this species were found.

11. **Ena (Napæus) potaninianus** Ancey.

Buliminus potaninianus { *Le Nat.*, 8^e année, No. 34, p. 270, 15th May, 1886.
 Bull. Soc. Mal. Fr., iii, p. 44, 4th July, 1886.

A number of this species found on 22nd March, 1935, in crevices in cretaceous limestone on the north side of the Uurchini Pass, 20 miles south of Isfahan on the road to Shiraz. Many alive and active crawling on the bare face of the rocks near the ground. Again in the hills east of Maiar, 30 miles south of Isfahan, many more specimens in a similar habitat.

12. **Ena (Petræus) alepensis** Pfr.

Bulimus alepensis Pfr. *Symb.*, i, p. 45, 1841.

Two dead shells of this species found in a bowl in a rock on the Dukhter Pass west of Shiraz. Evidently they had been washed in by the rain so there was no indication of their habitat and search in likely places revealed nothing.

13. **Ena** sp.

This undetermined species occurs in two places. Six specimens were found under a tree in débris in the valley above Seguch, south-east of Kerman and at about 7,500 feet. The following year I collected a few dead shells, apparently of the same species, in a valley in the mountains quite close to Kerman. It occurs in association with *Granopupa granum* Drap., and while collecting in the field may easily be taken for a long form of this species.

14. **Chondrula bayeri** Pfr.

Bulimus bayeri Pfr. *Malak. Bl.*, v, p. 240, 1858.

Abundant in gardens near Isfahan, especially those bordering on the Zeyandeh Rud River. On 1st December, 1926, I took 103 specimens in one garden, and on 8th March over 120, most of them living. Three pairs were taken in *coitu*. Most were covered with mud which renders them difficult to find at first.

15. **Granopupa granum** Drap

Pupa granum Drap. *Tab. Moll. France*, p. 59, 1801.

Common amongst vegetable débris in rock crevices in mountains east of Kerman. In April, 1932, found æstivating firmly attached to stones. Occurs also at Seguch, where many found æstivating in July of the same year, and at various heights up to 9,000 feet. Ground very dry.

16. **Pupilla (Primipupilla) signata** Mousson.

Pupa signata Mousson. *J. de Conch.*, xxi, p. 211, pl. viii, f. 7, 1873.

Abundant in situations similar to the foregoing.

17. **Pupilla muscorum** Linn.

Turbo muscorum Linn. *Syst. Nat.*, ed. x, p. 767, 1758.

I have only found this widely distributed species in one place in Iran, a water-logged patch on a barren mountainside near the top of Deh Bala valley, west of Yezd, at 9,500 feet. It was found under stones and in association with *Vitrina annularis* var. *persica* and *Vallonia adela* var. *mionecton*.

18. **Pupoides (Pupoides) cænopictus** Hutton var. **persicus** Schlesch.

Arch. für Moll., 66, p. 45, pl. 5, f. 5 and 6, 1934.

This little shell was found in abundance in a palm garden at Shahdad (Khabis) east of Kerman. I took over three hundred in a few hours. They were attached to débris round the base of the trees and in the axils of the palm leaves. Altitude about 1,800 feet. Herr Hans Schlesch informs me that this is the first record for the species in S. Iran.

19. **Pupoides** sp.

One dead shell found amongst débris under a bush at Seguch in July, 1932, at 8,000 feet.

20. **Pupoides** sp.

Two dead shells with the above but clearly of a different species.

21. **Vallonia adela** West. var. **mionecton** Bttg.

Zool. Jahr., iv, p. 941, pl. xxvi, f. 11 a-d, 1890.

Common in the Consulate garden in Kerman, Bagh-i-Shahzdeh, in copses by the Zeyandeh Rud at Isfahan and on water-logged ground under stones at 9,500 feet above Deh Bala. The variety was described by Boettger from Transcaspia at the height of 9-10,000 feet. The lowest altitude at which I have found it is Isfahan, about 5,100 feet.

22. **Cecilioides acicula** Müll.

Buccinum acicula Müll. *Verm. Hist.*, ii, 150, 1774.

A very few found buried in clods of earth round palm trees at Shahdad.

23. **Opeas gracile** Hutton.

Bulimus gracilis Hutton. *J.A.S. Bengal.*, vol. 3, p. 84, 1834.

Three dead shells found in palm garden at Shahdad.

24. **Cyclotus (Caspicyclotus) biggsi** Schlesch.

Arch. für Moll., 66, p. 45, pl. 5, f. 1-2, 1934.

The only locality at present known for this species is the mountains east of Kerman, where I found it in March, 1932. These mountains are composed of hippuritic limestone and *biggsi* is found at about 6,000 feet on the lichens which come to life when the snow melts and forms little trickles over the rocks. The active life of this species can only be about three or four months each year. For the rest it remains sealed to the rock, but as it is only found on the side facing north, is not exposed to the full glare of the sun, getting only the late afternoon and evening sun in the summer months. On 6th February, 1933, I took forty-two specimens. The shell is held high when moving, and the foot of an adult specimen is about 5.5 mm. when fully extended. Unfortunately I have not been able to find out much of the breeding habits of this species, in spite of many trips to the mountains in early spring. The young shells æstivate with the adults.

25. **Succinea pfeifferi** Rossm.

Icon. Land-u.-Süssw. Moll., i, p. 96, f. 46, 1853.

Very abundant in copses on the north bank of the Zeyandeh Rud at Isfahan. Occurs also at Qohrud, 72 miles north of Isfahan at about 7,000 feet. A fossil shell found in a recent deposit at Bam (borders of Persian Baluchistan) is probably to be referred to this species.

26. **Melanopsis præmorsa** Linn.

Buccinum præmorsum Linn. *Syst. Nat.*, ed. x, p. 740, 1758.

The shells which I have tentatively referred to this species are found in a *qanat* at Aqda, a village on the Isfahan-Yezd road. The adults are much eroded round the spire. The young specimens bear a close resemblance to the young of *præmorsa*, but in the adult specimens there is a flattening of the body whorl not found in this species. Up to the present I have not found any shells to compare with these in any other part of Iran. If the determination is correct it means that a colony of *præmorsa* exists in the middle of an area occupied by *M. doriæ* Issel.

27. **Melanopsis doriæ** Issel.

Mem. R. Acc. Sc. Torino (2), xxiii, p. 16, 1865.

The type of this species was described from Kerman, where I have taken many specimens. It occurs also at Nain, Erjenun, Kermanshahan, Anar, Qasemabad, and Shahdad. It is one of the most widely distributed species in S. Iran and varies considerably, for all the habitats are more or less isolated. At Anar, a village on the Yezd-Kerman road, they are small and pale, some being cream coloured. At Kermanshahan only very large forms are found. The average height for thirteen specimens taken at random is 27.03 mm. (largest 30.00 mm.), while the average for twenty specimens taken from the type locality is 21.09 mm. (largest 27.5 mm.). I have a short series taken at Khash (= Kwash or Vasht), in Persian Baluchistan, which are referable to this species. *Melanopsis deserticola* Ann. & Prashad described from this latter district seems to bear some resemblance to *doriæ*. The small study I have been able to make of this species inclines me to speak of the "*doriæ* complex" rather than species.

I have also taken the following varieties near Kerman:—

(a) var. **nigra** Biggs. *J. of C.*, Vol. 20, p. 60, 1934. Since describing this variety I have taken specimens at Hutk, a small village about 20 miles north of Kerman. They are very small specimens.

(b) var. **fasciata** nov. Characters generally as type but with a distinct chestnut peripheral band. Holotype, from a *qanat* (now dry) at Jelalabad, near Kerman, in my collection.

(c) var. **carinata** nov. Shell strongly keeled. Holotype, from Jelalabad, in my collection. Two specimens also found at Nain, east of Isfahan.

28. **Melanoides tuberculata** Müll.

Nerita tuberculata O. F. Müller. *Hist. Verm.*, vol. 2, p. 191, 1774.

Widely distributed. I have it from Kilekuh and Hajjiabad Deraga on the road between Bunder Abbas and Kerman, most of the *qanats* near Kerman itself, near Rafsanjan, Chah-i-Noh, Anar, and from Meimeh, 70 miles north of Isfahan. Again we have a species that should be called a complex, as many of those I have collected seem to be varieties or incipient species.

29. **Melanoides scabra** Müll.

Buccinum scabrum O. F. Müller. *Hist. Verm.*, vol. 2, p. 136, 1774.

Several specimens taken in a muddy stream at Hajjiabad Daraga in November, 1931. I have passed this spot on three occasions since then but failed to find any trace of the species.

30. **Hydrobia** sp.

One dead shell from a *qanat* at Nain, 84 miles east of Isfahan.

31. **Bythinella uzielliana** Issel.

Mem. Acc. R. Sc., Torino (2), xxiii, p. 19, 1865.

Very common in a stream at Taherabad, near Kerman, the type locality. Also found at Aqda and Erjenun on the Yezd-Kerman road, climbing on stones in the *qanats*.

32. **Amnicola (Alocinma) ejecta** Mousson.

Bythinia ejecta J. de C., xxii, p. 46, 1874.

Common in a *qanat* at Nagur, a small village in the mountains between Nain and Isfahan.

33. **Pseudamnicola ? raddei** Bttg.

Zool. Jahrb., iv, p. 970, pl. xxvi, f. 6 a-c, 1890.

Found in a stream at Kushkuh, 85 miles east by north of Kerman, January, 1923. Some dead shells found at Isfahan and Nain probably belong to this species.

34. **Theodoxus doriæ** Issel.

Mem. R. Acc. Sc. Torino (2), xxiii, p. 23, 1865.

Occurs at Robat, 30 miles west of Kerman, Aqda, Erjenun, and Nain. At Aqda a black form of this species is found; the beautiful zigzag markings can just be seen when the shell is held to the light but are very obscure. I therefore suggest the varietal name **obscura** for this form. Holotype in my collection, taken 23rd November, 1934. The variety is fairly common and there are some specimens collected at Nain.

35. **Lymnæa persica** Sowerby iii.

Conch. Icon., xviii, *Limnæa*, pl. xiv, sp. 92 a, b, 1872.

Taken in a pond by the roadside at Bambiz, an isolated village 4 miles south of Nain.

36. **Lymnæa lagotis** Schrank.

Buccinum lagotis Schrank. *Fauna Boica*, 3, 287, 1803.

A well-known and widely distributed species. I have taken it at Kerman, Qasemabad, and Nagur.

37. **Lymnæa truncatula** Müll.

Buccinum truncatulum Müll. *Hist. Verm.*, 2, p. 130, 1774.

I have taken this species from the following localities in Iran—Bam, Kerman, Baiaz, Deh Bala, Isfahan, Soh, Shalamzar, and Rai. The var. *major* is the only form found in a tiny isolated pond

on the mountains near Soh, north of Isfahan. At Rai (ancient Rages) I took it in a fast flowing stream and near Deh Bala at 10,000 feet on damp moss and grass where a little water oozes out of the barren mountain. On the opposite side of the valley, on the lower slopes of Shir Kuh, it lives in a stream at 10,500 feet and almost certainly would have been found higher up had I had time to climb and look for it.

38. **Planorbis** sp.

This undetermined species was common under stones in a pond at Dasht Arjan, west of Shiraz.

39. **Planorbis persicus** Ancey.

Nautilus, xiv, p. 84, 1900.

Common in a stream at Deh Lur about 50 miles north of Isfahan at 6,500 feet, and at Nachaft about 15 miles further north.

40. **Planorbis subangulatus** Philippi.

Enum. Moll. Siciliae, vol. 2, p. 119, pl. xxi, f. 6 (var.), 1844.

A few specimens in a pond 2 miles west of the Manun Bridge over the Zeyandeh Rud at Isfahan. One dead shell from Nain.

41. **Corbicula** ? **cor** Lam.

Cyrena cor. Lam. *Hist. Nat. An. s. Vert.*, v, 552, 1818.

Multitudes of dead shells in an irrigation canal at Isfahan, but only a few living specimens taken.

42. **Pisidium cinereum** Alder.

Tr. Nat. Hist. Soc. Northumberland, ii, 341, 1838.

Three specimens found in damp ground amongst grass on the lower slopes of Shir Kuh, east of Yezd at 10,500 feet. Mr. Oldham, who has kindly determined this species for me, reports that one specimen has the teeth reversed, all those proper to the right valve being found in the left valve and vice versa. The large quantities of *Pisidium* living in a stream at Kerman are near to *cinereum*. Mr. B. Prashad has, however, included them in his *P. persicum* (*Rec. Indian Mus.*, xxxv, p. 7, 1933).

In conclusion I should like to record my gratitude to Mr. Tomlin for his patient work in determining so many of the species enumerated here.

ENEMIES OF THE LAND AND FRESHWATER MOLLUSCA OF THE BRITISH ISLES.

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(Read before the Society, 14th March, 1936.)

THE following list of the known enemies of the land and fresh-water mollusca of the British Isles makes no pretence of being exhaustive. The writers, whilst reading various works have, from time to time, come across scattered references to the destruction of Mollusca by various creatures, but have not been able to trace any attempt to bring these records together in a handy form. The lists here given are intended to form a basis only and contain such records as have been available to the writers. It is freely acknowledged that many more records probably exist in works to which the writers have not had access. Man, and all domestic animals and birds have been excluded.

References have been made as concise as possible, and not more than two or three have been given in cases where numerous references to one enemy have been found. A bibliography is included in this paper. No order of priority has been adopted.

Many references are to a genus only and these are included under the generic name. In some instances enemies are only referred to in general terms, e.g. "Mice" and "Worms", and in such cases more accurate information is desirable.

Some enemies listed are possibly parasites only, but definite information is lacking as to whether their activities are fatal to molluscan life, and they are, therefore, included in the hope that further research may definitely establish their status.

The nomenclature followed is that adopted in the Census of British Land and Freshwater Mollusca by the late W. D. Roebuck, in this *Journal*, Vol. XVI, pp. 165-212.

In conclusion we would tender our thanks to Miss Fisher, Dr. Jackson, Messrs. C. H. Moore, G. C. Spence, R. MacDonald, and others who have assisted us in collecting data.

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 J. W. Taylor.
 N. D. Keilin (in *Parasitology*), 1919.
 O. *British Birds Magazine*.

Testacella.

Worms. A small Wireworm. M.2.5.

Limax.

Birds, frogs, toads, take adult and young. Wood Ant and several flies take the eggs. C.1068. M. V. Clarke. M.2.32.

Hedgehog. M.2.32.
 Blindworm. M.2.32.
 Frog. M.2.32.
 Toad. M.2.32.
 Blackbird. M.2.32.
 Thrush. M.2.32.
 Chaffinch. M.2.32.
 Starling. M.2.32.
 Plover. M.2.32.
 Curlew. M.2.32.
 Woodcock. M.2.32.
 Whinchat. M.2.32.

Coot. M.2.32.
 Quail. M.2.32.
 Oyster-catcher. M.2.32.
 Redwing. A.1.406.
 Golden Plover. A.2.533.
 Landrail. A.2.829; M.2.32.
Isospora rara (Gregarine). M.2.32.
Davainea proglottina (during one phase of life history). M.2.32.
Ascaroides limacis (Nematode worm) infests the eggs. M.2.32.

L. maximus L.

In addition to enemies of the group (given above) this species is infested by *Leptodera flexilis* (Nematode), M.2.39, and *L. angiostrongylus* (Nematode), M.2.39.

L. flavus L.

Larva of *Drilus flavescens*. M.2.82.

L. arborum Bouch.

"A species of *Carabus*." M.2.93.

Agriolimax.

A. agrestis L.

Hedgehog. M.2.110.
 Lapwing. A.2.549; D.235.
 Red Grouse. D.298.
 Little Owl. D.201.
 Wood Pigeon. A.2.479.
 Tawny Owl. A.2.94.
 Whimbrel. A.2.667.
 Rook. M.2.110.
 Pheasant. M.2.110.
 Quail. M.2.110.
 Fieldfare. M.2.110.

Blindworm (Slow-worm). B.9.
 161; E.144; M.2.110.
 Nematode Worms (*Rhabditis*). F.3.
 61.
 Nematode (*Ascaroides limacis*) infests even the eggs. M.2.110.
Albertia vermicularis (Rotifer).
 M.2.110.
Mermis nigrescens (Hair Worm).
 M.2.110.

Milax.

M. sowerbyi (Fér.).

Testacella maugei. B.20.149.

Vitrina.

V. pellucida (Müll.).

Golden Plover. A.2.533; O.29.183.

Hyalinia.Glow Worm larva (*L. noctiluca*). G.22.5.*Hy. crystallina* (Müll.).

Ants. B.16.127.

Hy. cellaria (Müll.).

Thrush. M.3.35.

Blackbird. M.3.35.

Starling. M.3.35.

Hy. nitidula (Drap.).

Stockdove. M.3.71.

Zonitoides.

Shrew. B.9.161.

Bank Vole. B.9.161.

Common Vole. B.9.161.

Water Rail. A.2.842.

Arion.

Redwing. A.1.406.

Common Crane. A.2.825.

Nematode Worms (*Rhabditis*). F.3.61.*Arion ater* (L.).

Hedgehog. G.22.5.

Badger. G.22.5.

Thrush. G.22.5.

Brown Owl. G.22.5.

Leptodera appendiculata and two other *Leptodera* not named. M.2.173.*A. subfuscus* Drap.

"In addition to the 'general enemies' of the Mollusca, numerous intestinal worms as yet unidentified." M.2.197.

A. hortensis Fér.

Lapwing. D.235.

Red Grouse. D.298.

Carabus violaceus. B.20.85.**Pyramidula.***P. rotundata* Müll.

Stockdove. M.3.475.

Song Thrush. M.3.475.

Ants. B.16.127.

Helicella.*H. virgata* Da Costa.

Mole. B.16.226.

"Mice." M.Pt.24.150-1.

Rock Dove. A.2.485 ; M.Pt.24.

150-1.

Stock Dove. M.Pt.24.150-1.

"Pigeons generally." M.Pt.24.

150-1.

Red Grouse. D.298.

Lapwing. M.Pt.24.150-1.

Wheatear. M.Pt.24.150-1.

Pheasant. M.Pt.24.150-1.

Fieldfare. M.Pt.24.150-1.

Redwing. M.Pt.24.150-1.

Starling. M.Pt.24.150-1.

Song Thrush. M.Pt.24.150-1.

H. itala L.

Rabbit. B.9.161 ; 18.327.

Field Mice. M.Pt.24.120-1.

Thrush. G.22.5 ; M.Pt.24.

120-1.

H. pisana Müll. H.358.*Ocyrops olens* (Devil's Coach Horse). H.360 ; M.Pt.24.

120-1.

Herring Gull—Seen devouring *virgata*, Tenby, Sep., 1935.—A. K. L.Glow Worm larva (*L. noctiluca*). G.22.5.*Melinda cognata* Meig. M.Pt.24.151 ; N.xiii.1921.*M. gentilis* (R-D) Verrall. M.Pt.24.150-1 ; N.xi.1919.*Sarcophaga nigriventris* Meig. N.xi.1919.*S. crassimargo* Pand. N.xi.1919.*Engyzops pecchiolii* Rond. N.xiii.1921.

Rock Dove. A.2.485 ; M.Pt.24.120-1.

Whimbrel. A.2.667 ; M.Pt.24.120-1.

Drilus flavescens. M.Pt.24.121.*Sarcophaga nigriventris* Meig. M.Pt.24.121 ; N.xi.1919.

H. caperata Mont.

Wood Pigeon. B.9.160.

Golden Plover. O.29.183.

Trochula.

T. elegans Müll.

Larva of *Drilus flavescens*. H.230.

Cochlicella.

C. barbara (L.).

Golden Plover. O.29.183.

Rock Dove. A.2.485.

Ringed Plover. O.29.183.

Sarcophaga setipennis Rond. N.xi.1919.

Theba.

T. cantiana Mont.

"Mice." M.Pt.23.84.

Song Thrush. B.13.323.

Thrushes. G.22.5; B.10.27; M.Pt.23.84.

Glow Worm larva (*L. noctiluca*). Observed at Folkestone, August, 1931.

—A. K. L. M.Pt.23.84.

Sarcophaga teretirostris Pand. N.xi.1919.

T. cartusiana Müll.

Coleopteron—*Phosphuga lævigata*. M.Pt.23.100.

Zonites algirus. M.Pt.23.100.

Ashfordia.

A. granulata Alder.

"Mice." M.Pt.23.74.

Hygromia.

H. hispida L.

House Sparrow. B.9.160; M.Pt.22.22.

Landrail. M.Pt.22.22.

Thrush. M.Pt.22.22.

H. striolata Pfeiffer.

Thrushes. G.22.5; H.355.

"No doubt Game birds."—J. R. B. Masefield, B.9.161.

H. limbata Drap.

Thrushes. G.22.5.

H. fusca Mont.

Bank Vole. M.Pt.22.50.

Arianta.

A. arbustorum L.

Bank Vole. M.3.422-3.

Woodlice. M.3.488.

Thrushes. G.22.5; M.3.422-3.

Phora bergenstammi Mik. N.xi.1919.

Song Thrush. B.13.323; 16.264.

Blackbird. M.3.422-3.

Phora bohemani Becker. N.xi.1919.

Newts. M.3.488.

Phora immaculata Strobl. N.xi.1919.

Leeches. M.3.488.

1919.

Helix.

Shrew. B.9.161.

Common Snipe. A.2.677.

Bank Vole. B.9.161.

Jack Snipe. A.2.681.

Common Vole. B.9.161.

Herring Gull. A.2.752.

Reed Warbler. A.1.341.

Landrail. A.2.829.

Wheatear. J.1.429.

Water-rail. A.2.842.

Kentish Plover. A.2.527.

Silpha quadripunctata. F.3.58.

Helix pomatia L.

Thrush. G.2.5.

Phora bergenstammi Mik. N.xi.
1919.*Phora bohemani* Becker. N.xi.
1919.*Phora immaculata* Strobl. N.xi.
1919.*Discomyza incurva* Fallen. N.xi.
1919.*Aphiochaeta rufipes* Meig. N.xi.
1919.*Homalomyia canicularis* L. N.xi.
1919.*Cercaria pomatiæ* Vaney and
Conte. M.3.218.*H. aspersa* Müll.Rabbit. B.9.161 ; 18.190 ; 19.
190 ; M.3.248.

Rats. M.3.248.

Moles. M.3.248.

Hedgehogs. M.3.248.

Field Vole. M.3.248.

Eel (Common Freshwater). K.8.
321.

Redwing. A.1.406.

Thrush. H.365 ; B.18.335 ;
M.3.248.

Blackbird. H.365 ; M.3.248.

Curlew. A.2.664.

Hyalinia lucida Drap. G.22.5.Glow Worm (*L. noctiluca*). H.365.*Drilus*, *Staphylinus*, *Silpha*. M.3.
248-9.*Phora maculata* Meig. M.3.248-
9 ; N.xi.1919.*Phora unispinosa* Zett. N.xi.1919.*Phora bergenstammi*. Mik. N.xi.
1919.*Phora bohemani* Becker. N.xi.
1919.*Phora immaculata* Strobl. N.xi.
1919.*Homalomyia canicularis* L. N.xi.
1919.*Aphiochæta rufipes* Meig. N.xi.
1919.*H. nemoralis* L.Rabbit. B.9.161 ; 12.268 ; M.
3.281.

Rats. M.3.281.

Field Mice. M.3.281.

Voles. M.3.281.

Hedgehog. M.3.281.

Song Thrush. K.364 ; B.13.
323 ; 16.264 ; 18.335 ; M.3.
281.

Wood Pigeon. B.16.227.

Curlew. A.2.664.

Pheasant. B.16.227.

Blackbird. M.3.281-2.

Glow Worm (*L. noctiluca*). B.16.
82 ; M.3.281.*Drilus flavescens*. G.22.5 ; M.3.
281-2.*Homalomyia canicularis* L. N.xi.
1919.*Aphiochæta rufipes* Meig. N.xi.
1919.*Phora bergenstammi* Mik. N.xi.
1919.*Phora bohemani* Becker. N.xi.
1919.*Phora immaculata* Strobl. N.xi.
1919.*Phora pressata* Becker. N.xi.1919.Eggs destroyed by Ants, Centipedes, Mollusca, and Dipterous larvæ.
M.3.281-2.*H. hortensis* Müll.

Rats. M.3.333-4.

Mice. M.3.333-4.

Hedgehogs. M.3.333-4.

Rabbits. M.3.333-4.

Eel (Common Freshwater). K.8.
321.Thrush. M.3.333-4 ; G.22.5 ;
B.16.264.

Blackbird. M.3.333-4.

Wood Pigeon. B.16.264.

Pheasant. B.16.227.

Drilus flavescens. G.22.5 ; M.3.
333-4.*Sarcophaga hæmorrhœa* Meig. N.
xi.1919.*Homalomyia canicularis* L. N.xi.
1919.*Aphiochæta rufipes* Meig. N.xi.
1919.*Phora bergenstammi* Mik. N.xi.
1919.*Phora bohemani* Becker. N.xi.
1919.*Phora immaculata* Strobl. N.xi.
1919.

Euparypha.

E. pisana (Müll.).

Hedgehog. M.3.488.
Mediterranean Black-headed Gull.
A.2.740.
Kestrel. M.3.376.
Wild Duck. M.3.376.
Crows. M.3.488.
Magpies. M.3.488.
Owls. M.3.488.

Testacella devours the young.
M.3.488.
Coleoptera (Carabids and Lampy-
rids). M.3.488.
Salpicella fasciata Meigen. N.xi.
1919.
Helicobasca muscaria Meigen.
(Found larval in dead snails).
N.xi.1919.

Ena.

E. obscura (Müll.).

"Birds." H.370.

Cochlicopa.

C. lubrica (Müll.).

House Sparrow. B.9.160.

Pupa.

Bearded Titmouse. A.1.259. "Insects." H.373.

Balea.

B. perversa (L.).

Wall Creeper. A.1.220. (One record only.)

Clausilia.

"Beetles and Birds." H.374-5. Norwegian Bluethroat. A.1.474.
C. bidentata Strom.
Tits. B.9.374. (Observed mutilating shells.)

Succinea.

Bearded Titmouse. A.1.259. Wood Pigeon. A.2.479.
Black-winged Stilt. A.2.649.

S. putris (L.).

Wagtail. H.381.
Thrush. H.381.

Blackbird. H.381.
Bearded Titmouse. F.3.58.

Ancylus.

Dipper. D.156.

Little Crake. A.2.837.

A. fluviatilis Müll.

Dipper. B.9.161.
Water Rail. B.9.161.
Moorhen. B.9.161.
Coot. B.9.161.

"The Waders." B.9.161.
"Fish." B.9.161.
Grey Wagtail. J.1.106.

Limnæa.

Rat. F.3.58.
Grey Wagtail. J.1.106.
Glossy Ibis. A.2.197.
Tufted Duck. A.2.324.

Common Eider. D.224.
Little Grebe. A.2.464.
Red-necked Phalarope. A.2.644.
Spotted Crake. A.2.832.

L. auricularia (L.).

Kingfisher. D.176.

L. pereger (Müll.).

Dipper. D.156.
Kingfisher. D.176.
Goldeneye. A.2.335.
Lapwing. D.235.

Ringed Plover. O.29.183.
Red Grouse. D.298.
Song Thrush. O.29.243.
Dytiscus marginalis. F.3.59.

L. palustris (Müll.).

Kingfisher. D.176.

L. truncatula (Müll.).

Pied Wagtail. L.88.

Lapwing. D.235.

Moorhen. D.278.

L. stagnalis (L.).

Brown Rat. B.16.144.

Goldeneye. A.2.335.

Water Vole. B.18.327.

Dytiscus marginalis. H.312.

Dipper. D.156.

F.3.59.

Kingfisher. D.176.

(H. H. Higgins' presidential address to Liverpool Naturalists' Field Club, 1891, p. 14.)

Planorbis.

Bats. B.9.162.

Slavonian Grebe. A.2.455.

Aquatic Warbler. A.1.351.

Little Grebe. A.2.464.

Dipper. D.156.

Broad-billed Sandpiper. A.2.600.

Kingfisher. D.176.

Greenshank. A.2.633.

Glossy Ibis. A.2.197.

Common Snipe. A.2.677.

Garganey. A.2.290.

Little Crake. A.2.837.

Pintail. A.2.303.

Water Rail. A.2.842.

Shoveler. A.2.309.

Pheasant. D.285.

P. corneus (L.).

Water Vole. B.18.327.

Song Thrush. O.29.243.

P. carinatus (Müll.).

Red Grouse. D.298.

P. leucostoma (Millet).

Natterjack Toad. B.9.161.

Physa.

Dipper. B.9.161.

Moorhen. B.9.161.

Golden-eye. A.2.335.

Coot. B.9.161.

Lapwing. A.2.549.

"The Waders." B.9.161.

Black-winged Stilt. A.2.649.

"Fish." B.9.161.

Water Rail. B.9.161.

Paludestrina.

British Golden Plover. A.2.533. Knot. A.2.533.

Grey Phalarope. A.2.641.

P. jenkinsi (Smith).

Scaup. B.1616.319.

Perch. B.11.15.

Carp. B.11.15.

Roach. B.11.15.

Dace. B.11.15.

Bithynia.

Little Grebe. A.2.464.

Spotted Crake. A.2.832.

Lapwing. A.2.549.

Little Crake. A.2.837.

Curlew. A.2.664.

Water Rail. A.2.842.

Paludina.

Rat. F.3.58.

Sheld-duck. A.2.262.

"Bats." B.9.162.

Little Grebe. A.2.464.

P. contecta (Millet).

Perch. B.11.15.

Minnow. B.11.15.

Valvata.

Dipper. B.9.161.

Moorhen. B.9.161.

Little Grebe. A.2.464.

Coot. B.9.161.

Little Crane. A.2.837.

"The Waders." B.9.161.

Water Rail. B.9.161.

"Fish." B.9.161.

V. piscinalis (Müll.).

Eel (Common Freshwater). B.9.162.

Dreissensia.

D. polymorpha (Pallas).

Water Vole. B.9.161.

Rat. B.9.161.

Anodonta.

Bats. B.9.162.

Rook. L.88.

Otter. E.61; B.10.306.

Jackdaw. B.9.161.

Water Vole. E.61.

Heron. A.2.201; B.10.306.

Rat. B.9.161.

Common Eider. D.224.

Common Scoter. A.2.372.

A. cygnea (L.).

Mute Swan. B.11.318.

Otter

Brown Rat

Common Heron

} Shells in the J. W. Taylor Collection.

A. anatina (L.).

Rats. Shells in J. W. Taylor Collection.

Sphaerium.

Water Shrew. B.9.161.

Golden Plover. A.2.533.

Pisidium.

Common Pochard. A.2.317.

Scaup Duck. A.2.330.

Tufted Duck. A.2.324.

Jack Snipe. A.2.681.

Water Rail. A.2.842.

P. casertanum Poli.

Scaup Duck. B.16.319.

P. subtruncatum Malm.

Scaup Duck. B.16.319.

ALPHABETICAL LIST OF MOLLUSCAN ENEMIES.

In the following classified lists names have been included which are recorded as "preying on mollusca" but, no specific species of mollusc having been given, such enemies do not appear in the foregoing molluscan list.

Mammals.

Badger

Rat, Black

Bats

Rat, Brown

Fox

Shrew, Common

Hedgehog

Shrew, Water

Mole

Vole, Bank

Mouse, Field

Vole, Common or Field

Otter

Vole, Water

Rabbit

Birds.

The following birds are definitely noted as taking "land" and/or "freshwater" mollusca or their eggs, including those where the genus and/or species of mollusca is given.

Bittern, Little
 Blackbird
 Bluethroat, Norwegian
 Bunting, Yellow
 Chaffinch
 Coot
 Courser, Cream-coloured
 Crake, Little
 Crake, Spotted
 Crane, Common
 Creeper, Wall
 Curlew, Common
 Dipper, British
 Dove, Rock
 Dove, Stock
 Duck, Buffel-headed
 Duck, Scaup
 Duck, Sheld
 Duck, Tufted
 Egret, Little
 Eider, Common
 Fieldfare
 Garganey
 Godwit, Black-tailed
 Golden-eye
 Grebe, Great-crested
 Grebe, Little
 Grebe, Slavonian
 Greenshank
 Grouse, British Red
 Gull, Herring
 Gull, Mediterranean Black-headed
 Heron, Common
 Heron, Great White
 Ibis, Glossy
 Jackdaw
 Kingfisher
 Knot
 Lapwing
 Magpie
 Mallard
 Merganser, American Hooded
 Moorhen
 Owl, British Tawny
 Owl, Little
 Oyster Catcher

Phalarope, Grey
 Phalarope, Red-necked
 Pheasant
 Pigeon, Wood
 Pintail
 Pipit, Meadow
 Pipit, Red-throated
 Plover, Southern Golden
 Plover, Grey
 Plover, Kentish
 Plover, Ringed
 Pochard, Common
 Quail
 Rail, Land-
 Rail, Water-
 Redshank, Spotted
 Redwing
 Rook
 Ruff
 Sandpiper, Broad-billed
 Sandpiper, Green
 Sandpiper, Marsh
 Sandpiper, Wood
 Scoter, Common
 Shoveler
 Smew
 Snipe, Common
 Snipe, Jack
 Sparrow, House
 Starling
 Stilt, Black-winged
 Stone-Curlew
 Swan, Mute
 Swan, Whooper
 Teal
 Thrush, British Song
 Titmouse, Bearded
 Wagtail, Grey
 Wagtail, Pied
 Warbler, Aquatic
 Warbler, Reed
 Wheatear
 Wheatear, Greenland
 Whimbrel
 Woodcock

Birds definitely noted as taking "slugs" and/or "snails" or their "eggs" which, from their usual habitats, probably take land and/or freshwater species.

Accentor, Alpine
 Bunting, Corn
 Bunting, Ortolan
 Bustard, Great
 Bustard, Eastern Little
 Bustard, Macqueen's
 Buzzard, Honey
 Cuckoo
 Cuckoo, American Yellow-billed

Dunlin, Southern
 Dunlin, Lapland
 Gull, Black-headed
 Gull, Common
 Hedge Sparrow, British
 Heron, Night
 Jay, British
 Lark, Sky
 Lark, Wood

Ouzel, Alpine Ring-
Partridge, Common
Partridge, Red-legged
Pipit, Rock
Pipit, Scandinavian Rock
Pipit, Water
Pipit, American Water-
Robin, British
Robin, Continental
Sandpiper, Spotted

Snipe, Great
Thrush, Mistle
Thrush, Continental Song
Thrush, Hebridean Song
Warbler, Cetti's
Warbler, Icterine
Warbler, Great Reed
Warbler, Sedge
Wheatear, Eastern Black-eared

Birds noted as taking "Mollusca" and from the usual habitat of which, it is probable that land and/or freshwater species are taken :—

Bunting, Reed
Buzzard, Common
Chough
Crake, Baillon's
Crake, Carolina
Crow, Carrion
Crow, Hooded
Curlew, Eskimo
Curlew, Slender-billed
Dipper, Irish
Dotterel
Duck, Ferruginous
Duck, Ruddy Sheld-
Gadwall
Godwit, Bar-tailed
Goosander
Grebe, Black-necked
Gull, Great Black-backed
Gull, British Lesser Black-backed
Heron, Squacco
Kite, Black

Nuthatch, British
Oriole, Golden
Ouzel, Ring
Plover, Asiatic Golden
Plover, Northern Golden
Plover, Semi-palmated Ringed
Pochard, Red-crested
Raven
Redshank, Common
Sandpiper, Common
Sandpiper, Curlew
Sandpiper, Solitary
Spoonbill
Stork, White
Thrush, Rock
Titmouse, British Great
Titmouse, Continental Great
Wagtail, Blue-headed
Wagtail, Yellow
Whinchat

Fish.

Bream, Common
Bream, White
Carp. B.11.15.
Char
Dace. B.11.15.
Eel
Grayling
Gudgeon

Minnow
Perch
Pollan
Roach
Ruffe
Tench
Trout

(See *Freshwater Fishes of the British Isles*. C. Tate Regan, 1911.)

Reptiles.

Slow-worm

Viper

Amphibia.

Frog, Common
Toad, Common

Toad, Natterjack
"Newts."

Crustacea.

Crayfish

Woodlice

Worms, etc.

Ascarioides limacis
Leptodera angiastrum
Leptodera appendiculata
Leptodera flexilis

Mermis nigrescens
 Nematode worms (*Rhabditis*)
 "Leeches."

Mollusca.

Euparypha pisana
Hyalinia alliaria
Hyalinia cellaria
Hyalinia lucida
Hyalinia nitidula
Hyalinia radiatula

Hyalinia rogersi
Limas maximus
Milax gagates
Testacella haliotideia
T. maugei

Vitrina sp.

(See A. E. Boycott, *Journal of Ecology*, 22, 3.4.5.)

Insects.

Ants, Red and Wood
Aphiochæta rufipes Meigen
Carabus, A species of
Discomyza incurva Fallen
Drilus flavescens—larva of
Dytiscus marginalis and larva
Engyrops pecchiolii Rond.
Helicobosca muscaria Meigen
Homalomyia canicularis L.
Lampyrus noctiluca, larva of
Melinda cognata, Meig.
Melinda gentilis (R-D) Verrall
Ocypus olens

Phora bergenstammi Mik.
Phora bohemani Becker
Phora immaculata Strobl
Phora maculata Meigen
Phora pressata Becker
Phora unispinosa Zett.
Salticella fasciata Meigen
Sarcophaga crassimargo Pand.
Sarcophaga hæmorrhœa Meig.
Sarcophaga nigriventris Meig.
Sarcophaga setipennis Rond.
Sarcophaga teretirostris Pand.

Various.

Albertia vermicularis (Rotifer)
 Centipedes.
Davainea proglottina

Isospora rara (Gregarine)
Phosphuga lævigata (Coleopteron)
 "Small wireworm."

Nucella lapillus at Knott End, near Fleetwood.—During the month of August, 1904, some members of the Conchological Society obtained from the side of the breakwater at Knott End, Fleetwood, a number of specimens of *Nucella lapillus*, then known as *Purpura lapillus*. (See *Journal*, Vol. 11, 1904, p. 115.) This year, wishing to see if the colony still existed, I went across the ferry and out on the breakwater. Where the colony formerly existed on the stones of the breakwater there were no signs of the shells; but after some time spent in hunting under loose stones, a few were found adhering to the under-surfaces of the same. The locality, however, seemed to be confined to a small area of about 5 yards square, and is apparently dwindling, probably on account of sewage, signs of which were noticed. It would be interesting to obtain the experiences of other collectors with respect to this and other similar localities.—C. H. MOORE. (*Read before the Society*, 14th November, 1936.)

NOTES ON BRITISH OPISTHOBRANCHS. 1. THE ECOLOGY OF ARCHIDORIS FLAMMEA (A. & H.).

By NORA FISHER.

THE Nudibranch *Archidoris flammea* (A. & H.) appears to be a rare species and little is known of its ecology. Details of the Greenisland (Co. Antrim) specimens upon which the following account is based are as follows :—

<i>Date of Capture.</i>	<i>Colouring.</i>	<i>No. Specs. taken.</i>	<i>Length (extended).</i>
A. 4-11-1934.	Pure scarlet. Rhinophores orange with scarlet lamellæ.	1	30 mm.
B. 30-12-1934.	Scarlet, mottled with small purple spots. Branchiæ edged dull purple. Rhinophores uniform scarlet.	1	33 mm.
C. 31-12-1934.	Pure scarlet	1	10 mm.
D. 16- 2-1935.	Scarlet, blotched pale purple.	1	27 mm.
E-F. 18-2-1935.	Scarlet, blotched pale purple.	2	10-12 mm.

Habitat.—According to Eliot (1), p. 21, *A. flammea* “lives on red sponge”, but although a bright red sponge, *Hymeniacidon sanguinea*, is abundant between tidemarks at Greenisland, repeated searches during the spring, summer, and autumn of 1934, 1935, and 1936 yielded no *A. flammea*. Winter proved more profitable. A was found at low water crawling on a bare reef of Trias, where the bright scarlet mollusk was a highly conspicuous object on the dull-red marl. The nearest patch of *Hymeniacidon* was about 100 yards distant. This specimen was sent to Mr. R. Winckworth, who kindly confirmed my tentative identification of it. B was found resting on a pale yellow sponge, *Halichondria fibrosa* (Fristedt) under a stone near L.W.M. There were patches of the *Hymeniacidon* only a few inches away. C occurred in a most unlikely habitat. The marl which is visible in places on the Greenisland shore is easily split, and a foot-square slab about 2 inches thick levered off the parent-mass revealed the following assortment of animals beneath it: *Sagartia* sp., several; a large green-and-pink Nereid worm; *Cirratulus cirratus* (O. F. Müller), several; *Porcellana platycheles* Pennant, two; *Paphia saxatilis* (Fleuriau), several, and one small *Archidoris flammea*. No *Hymeniacidon* within 50 feet of the spot. D was found beneath a stone lying on a marl-bed at about half-tide mark, where the nearest *Hymeniacidon* was quite

500 yards distant. And finally E and F were obtained beneath stones at L.W.M.; the nearest *Hymeniacidon* was in one case about 50 feet and in the other about 20 feet distant.

Food.—Eliot (1), p. 5, footnote, states that *A. flammea* eats red sponges, and Garstang (2), p. 444, found it feeding "on a red *Desmacidon*-like sponge" at Plymouth, but no more definite information was available. Therefore the two specimens, B and C, were used to test the animal's taste in food. Both were active, and appeared perfectly normal and healthy in every way. On 30th December B was given some pieces of the pale yellow sponge, *Halichondria fibrosa*, upon which it had been resting when found, but although watched closely for some hours that evening it made no attempt to eat the *Halichondria*. When the yellow sponge was removed and some of the red *Hymeniacidon* substituted the mollusk at once crawled on to it, and in about two hours had eaten out a semi-circular piece about 9 mm. across. Next the red sponge was removed and *Archidoris* left fasting until the following morning, when some of the common yellow *Halichondria panicea* (Pallas) was given to it. But even when the nudibranch was placed actually on top of the sponge it always crawled off again at once. For several hours it was watched closely, and during that time did not eat any of the yellow sponge, and, if placed on it, at once moved off again. Specimen C was not tested with the red sponge, but when tried with the yellow *Halichondria panicea* behaved as B did, and ignored it. Another specimen (E) was placed with some *Hymeniacidon* and also some *Halichondria panicea*, but although I watched carefully for some hours it paid no attention to either sponge. This negative result may have been due to the mollusk having been captured only a few hours earlier, but unfortunately lack of time prevented me from repeating the experiment.

Breeding Habits.—I have been unable to trace any reference to the breeding habits of this species. The six Greenland specimens were each kept for a few days in captivity, but none spawned, nor could I find spawn on the shore. The specimen, apparently adult, taken 30th December, 1934, was in breeding condition. In captivity it repeatedly crawled to just above the water-level, and then raised the right side of its mantle, revealing the dilated genital aperture. Sauvage (3), p. 27, has noted this habit among the Doridids, and I have noticed that *A. britannica* (Johnston) behaves in this way just before pairing.

Eliot (1), p. 27, states that Nudibranchs "probably take little nourishment during the breeding season" and that "in the period immediately before spawning the stomach is found to be empty". If this is so, then some time must elapse between pairing and

deposition of the spawn, for the Greenisland *Archidoris flammea* B ate greedily of *Hymeniacidon*, yet appeared eager to mate.

Nothing definite is known of the periodic movements (if such exist) for breeding or other purposes of *A. flammea*, and the following conclusions must be regarded as tentative only.

It is perhaps significant that the only specimens obtained at Greenisland during nearly a dozen years' collecting are the six mentioned in this paper. They were collected 4th November–18th February, a period during which I had been able to do very little collecting in previous years. A fortnight later, during the March spring tides, a vain effort was made to find further specimens; on the other hand, *A. britannica*, which through the autumn and winter of 1934–5 had been absent, reappeared in great numbers. From March, 1935, until April, 1936, no more *A. flammea* were obtained, though frequently searched for.¹ The unusual severity of the weather may perhaps have been responsible, or was its appearance in the winter of 1934–5 due to the unusual warmth of the summer of 1934?

Perhaps this mid-winter appearance of *A. flammea* between tide-marks may be related to some particular phase of development of its food-animal, the sponge *Hymeniacidon sanguinea*. Dr. M. Burton tells me that "Growth [of the *Hymeniacidon*] appears to be greatest during the winter months, and it is probable that maximum development is obtained at this period also". At Greenisland it is common between tidemarks, and appears to be more abundant during the winter. Possibly, therefore, *Archidoris flammea* migrates inshore during the winter, feeds for some time on the *Hymeniacidon*, then pairs and spawns. Unfortunately this otherwise plausible theory does not account for the presence of the three small specimens (C, E, and F), unless such small specimens are sexually mature and breed? Also, presuming that the young *A. flammea* live in waters beyond L.W.M., as their absence from the shore during the summer would suggest, on what do they feed? Because, according to Stephens (19, p. 68), *Hymeniacidon sanguinea* is "not found, or is, at least, very rare in even shallow water dredgings off the Irish coast, but, with *Halichondria panicea*, it is the commonest sponge between tidemarks round our shores." Does another equally suitable red sponge replace *Hymeniacidon sanguinea* beyond tide-marks at Greenisland?

Elsewhere *Archidoris flammea* appears to occur at all seasons; the records I have collected show that it has been found during the following months: February, Kilkee; April, Plymouth (a); June, Plymouth (b) and Lamlash; August, Ballaugh, Isle of Man, and Valentia (b); July–September, Valentia (a); "Summer,"

¹ No further specimens found during the winters 1935–6 and 1936–7.

Jersey, Guernsey, and Herm ; November, Plymouth (d). All these records (except the Kilkee and Channel Island ones) refer to *dredged* specimens.

A. flammea is always rare and only taken singly or very sparingly (the Channel Island records are exceptional).

Variation.—This species appears to vary but little. Alder & Hancock (4, p. 330) describe the type-specimens as “ bright orange-scarlet ; occasionally blotched with purple. Dorsal tentacles orange, with bright scarlet lamellæ. Length nearly an inch, breadth one-half as much ”. One of the types was pure scarlet, the other “ scarlet, with a few blotches of purple on the back, and a pale purple or lilac margin to the branchial plumes ”. Forbes (10, p. 103) describes his two Manx specimens as “ most vivid orange-red, with lighter specks on the back. Ten branchiæ, bright red edged blackish-green ”. As regards size few data are available. Vayssièrè (20, p. 317) gives “ Longueur 24 mm., sur 11 mm. de largeur ”, and apart from the Greenisland specimens the following dimensions are recorded (for convenience all measurements have been reduced to mm.) :—

<i>Locality.</i>	<i>Date of Capture.</i>	<i>Size.</i>	<i>No. Taken.</i>
Kilkee, Co. Clare. (shore, half-tide).	15-2-1909.	26 mm.	1
Plymouth, 4-5 fm.	April, 1890.	ca. 20 by 13 mm.	1
Do. Do.	Early June, 1890.	12-13 mm.	1
Ballaugh, Isle of Man.	Aug., 1838.	Larger, 38 by ca. 20 mm.	2

“ Formule radulaire 36, 0, 36 ” (Vayssièrè, loc. cit.).

Protective Colouration.—Garstang (2, pp. 444-5) suggests that the close similarity in both colour and texture of *Archidoris flammea* to the sponge *Hymeniacidon* upon which it feeds is a case of protective resemblance, and he instances his difficulty in “ spotting ” the mollusk when on the sponge. Eliot (1, p. 21) also mentions this protective resemblance. A consideration of all available records causes one to doubt this statement ; the mollusc is usually associated with the sponge, but does not by any means always occur *on* the sponge, where alone its “ protective colouration ” would be of service. Except when actually on the *Hymeniacidon* *Archidoris flammea* is a conspicuous object. The eagerness shown by one captive specimen to get on to the *Hymeniacidon* appeared to be due to hunger, and not to any desire for concealment, and an attempt to make another specimen “ choose ” between red *Hymeniacidon* and yellow *Halichondria* gave only a negative result.

Geographical Distribution.—*Archidoris flammea* is at present known to occur only in the British Isles and at Wimereux, North France.

TABLE OF RECORDS OF ARCHIDORIS FLAMMEA (ALDER & HANCOCK).

Locality.	Bibl. Ref.	Habitat.	Dist. Sponge.	Comments.
ENGLAND.				
Plymouth (a)	2, p. 444.	On red sponge, Duke Rock, 4-5 fm.	{ In abundance, in inter-tidal and shallow water (7, p. 62).	{ "Has been found in other places than those listed, usually associated with <i>Hymeniacion sanguinea</i> ," O'Donoghue, in lit.
Do. (b)	Do.	Duke Rock, 4-5 fm.		
Do. (c)	7, p. 275.	Queen's Ground or Duke Rock, 4-6 fm.		
Do. (d)	Do.	On red sponge, Duke Rock, 4-5 fm.		
Falmouth.	8, p. 58.	On stones, extreme L.W.O. S.T., Gwyllyn-Vase.	Gwyllyn-Vase, etc., common (8, p. 99).	
Do.	9, p. 156.	Between tidemarks.	Common locally (9, p. 120).	
ISLE OF MAN.				
Ballaugh.	10, p. 103.	On a shellbank, 20 fm.	Common everywhere (Bruce, in lit.)	"The only record." Bruce, in lit.
IRELAND.				
Lough Ine, Co. Cork.	11, p. 423.	Rock-slabs, shore, Southern's Bay.	{ Everywhere, <i>Fucus</i> zones to below L.W.O.S.T. Renouf, in lit.	{ From the dist. of <i>Hymeniacion</i> I should say it is not their food." Renouf, in lit.
Lough Ine.	Do.	Dredged, Tragemona Bay.		
S.W. Ireland.	12, p. 178.	No data.	{ Frequent? (13, p. 761).	
Valentia, Co. Kerry.	13, pp. 780 & 848.	On a red sponge (<i>Hymeniacion</i>) shell-beds, 5-7 fm.		
Valentia.	13, p. 780.	On a red encrusting sponge (? <i>Hymeniacion</i>), Nullipore Ground, ca. 4 fm. On a rock at half-tide.		
Kilkee, Co. Clare.	14.	No data.	No data.	
Birterbuy Bay, Co. Galway.	15, p. 594.	No data.	No data.	

Locality.	Bibl. Ref.	Habitat.	Dist. Sponge.	Comments.
SCOTLAND.				
Rothesay Bay, Bute.	4, p. 330.	Dredged up on <i>Pecten oper-</i> <i>cularis</i> in shallow water.	{ " In this district grows be- tween tide-marks, often well above half-tide— also among <i>Laminaria</i> roots." Elmhirst, <i>in lit.</i>	The types. (2.) "No recent records for this area." Elmhirst, <i>in lit.</i>
Cumbræ, Clyde.	16, p. 7242.	Dredged, deep water W. of Cumbræ.		
Lamlash, Arran.	17, pp. 293 & 360.	Dredged.		
CHANNEL ISLANDS.				
Jersey.	18, pp. 40, 61.	Zostera meadows between tide-marks.	{ Common.	
Guernsey. Herm.	Do. 18, p. 61.	Do. Between tide-marks.		
FRANCE.				
Wimereux, nr. Boulogne.	20, p. 317.	No data.	Recorded from La Manche by Topsent, as <i>H. carun-</i> <i>cula</i> Bowerbank. ¹	Appears to be the only extra-Brit. record.

¹ See *Mém. Soc. Zool. de France*, ix, 127, 1896.

Abraham (5, p. 204) doubtfully identifies the French *Doris argus* of Bouchard-Chantereaux with *A. flammea*, but Sauvage (3, p. 26) states: "Le véritable *Doris argus* a une couleur rouge et est voisin du *Doris flammea* A. & H.: il habite la Méditerranée," and Iredale & O'Donoghue (6, p. 238) give no continental synonyms of *A. flammea*.

The table on pp. 366-7 gives all the data which could be obtained concerning all records of *A. flammea*; from this it will be seen that its British range is mainly south and south-west, and coincides roughly with the area in which *Hymeniacidon sanguinea* is abundant. Dr. H. O. Bull tells me that on the Northumberland-Durham coast *Hymeniacidon* is rare and *A. flammea* appears to be absent.

CONCLUSION.

(1) Although *Archidoris flammea* (A. & H.) is usually associated with the red sponge *Hymeniacidon sanguinea* (Grant), upon which it feeds, the colour-similarity does not appear to be protective.

(2) Two captive specimens were experimented with; both showed a definite dislike for the yellow sponge *Halichondria panicea* and refused either to eat or even to remain on it. The red sponge, *Hymeniacidon sanguinea*, was eagerly devoured by the one mollusk to which it was offered.

(3) *Archidoris flammea* is only known to occur in the British Isles and at Wimereux, near Boulogne, Northern France; its Britannic range is mainly south and south-west. It occurs in areas where *Hymeniacidon sanguinea* is abundant and the limiting factor of its distribution appears to be the presence of this sponge.

My thanks are due to the following for information concerning some of the records of *A. flammea*: Mr. J. R. Bruce, Dr. H. O. Bull, Dr. R. Elmhirst, Dr. M. V. Lebour, Dr. C. H. O'Donoghue, Professor L. P. W. Renouf, and Mr. J. R. le B. Tomlin. I would also like to thank Dr. M. Burton who kindly named the sponges and gave me much information regarding them, and Mr. R. Winckworth for encouragement and help.

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An Unusual Habitat of *Helicella caperata*.—The North Breakwater at Fishguard stretches from an area of waste land and railway sidings eastward into the bay. On its northern—and seaward—side is a stone balcony or terrace some 30 feet in width which is flanked by a stone wall 15 feet in height. Tucked in under the southern side and skirting the harbour is a railway track. On the terrace at 120 to 150 yards from its western—and landward—end, some clinkers and sand have accumulated in shallow patches from 5 to 10 feet long, probably blown along the terrace from the railway sidings. These patches have been colonized by scurvy grass and sea plantain, and there in June, 1936, were many living and some dead *Helicella caperata*, mature and part grown. The mature shells suggested that the snails were neither pioneers nor sojourners, but settled residents. They—or more probably their progenitors—may have been blown along the terrace like the clinkers and sand, or may have crawled along the terrace from the waste ground, or, which seems less likely, may have scaled the 15 ft. wall from the railway track on its southern side. However that may be, the snails, like the beetles, mites, and other animals living in the clinker patches, are subject to frequent deluging by sea-water in rough weather. *H. caperata* lives in mats of sea campion on the shifting shingle of storm beaches on the coast of Norfolk (*Trans. Norf. and Norw. Nat. Soc.*, xiii, p. 453), a habitat even more austere one would think than the breakwater, but in Norfolk it has two spartan associates, whilst at Fishguard no other snail has obtained a footing on the meagre oases of the clinker patches.—CHAS. OLDHAM. (Read before the Society, 14th November, 1936.)

THE GENUS *XYMORUS* GEBLER.

By H. A. REHDER.

(Read before the Society, 8th May, 1937.)

THE institution of this genus is to be found, according to the "Index Animalium", in the *Bulletin Soc. Imp. Nat. Moscou*, vol. i, 1839, p. 51. Sherborn got this reference from Porro (*Not. Bibl. Malac.*, 1840, p. 36), adding that he was unable to find this genus in the place quoted.

Interested in correctly placing this genus, which Porro put in the *Bulimidæ*, I looked up the matter and was successful in locating it. It appears in volume i of the above mentioned periodical, which, however, appeared in 1829, and not in 1839. On pages 51 to 59 Gebler has an article on the Museum at Barnaul, near Tomsk, Siberia ("Notice sur le Musée de Barnaoul en Sibirie"), and gives on page 55 a list of the mollusks found in that region. In a second article (pp. 184-6) he repeats the list (p. 185), with some corrections to which Ehrenberg, who was visiting the region with von Humboldt, had called his attention. Here we find the name *Xymorus auricularius*, which in the previous article had been written *B. [ulimus] auricularis* [sic]. This is without doubt the shell now known as *Radix auricularia* L., and *Xymorus* Gebler, 1829, becomes, therefore, an exact synonym of *Radix*, Montfort, 1810. Middendorff (*Sibirische Reise*, vol. 2, pt. 1, 1851, p. 293) mentions the presence of this species at Barnaul. The correct reference will therefore be: *Xymorus* Gebler, *Bull. Soc. Imp. Nat. Moscou*, vol. i, 1829, p. 185.

PROCEEDINGS OF THE CONCHOLOGICAL SOCIETY OF GREAT BRITAIN & IRELAND.

640th Meeting, held at the Manchester Museum, 13th February, 1937.

Mr. G. C. Spence in the chair.

Election of New Member.

Robert B. Janson.

Candidate Proposed for Membership.

Mrs. J. E. Whitmore, 124 South Broadway, Redondo Beach, California, U.S.A. (introduced by Mrs. Morehouse and Mrs. Mellor).

Member Deceased.

John Davy Dean.

Papers Read.

"*Ancylus fluviatilis* in Aquaria," by Ernest Dearing.

"Notes on Northern Mollusca: I," by Hans Schlesch.

"Some Zoogeographical Corrections," by Holger Madsen.

"Orkney Land and Freshwater Shells," by J. R. le B. Tomlin.

Exhibits.

By Mr. C. H. Moore : *Planorbis corneus* var. *major* Pascal (33.5 mm.) from Bohemia.

There was a special exhibit of Land Shells of Ceylon.

641st Meeting, held at the Manchester Museum, 13th March, 1937.

Mr. G. C. Spence in the chair.

Election of New Member.

Mrs. J. E. Whitmore.

Candidate Proposed for Membership.

Brian Seymour Vesey-Fitzgerald, 200 Watford Way, London, N.W. 4 (introduced by C. Oldham and J. W. Jackson).

Paper Read.

Clausilia dubia Drap., by R. H. Moses.

Exhibits.

By Mr. G. C. Spence : *Afripomus* and *Viviparus* spp. from Albert Nyanza.

By Mr. A. K. Lawson : Photographs of land shells in natural habitats.

By Mr. F. Taylor : Fry of *Hydrobia jenkinsi* Smith from Boating Lake at Alexandra Park, Oldham.

By Miss Fisher : Sets of the following species to illustrate adults and juveniles : *Pecten maximus* (L.), Valentia, Co. Kerry (Miss M. J. Delap) ; *Spisula solida* (L.), Magilligan, Co. Londonderry (Miss Fisher) ; *Spisula subtruncata* (da Costa), Southport, Lancs. (W. H. Heathcote) ; *Abra tenuis* (Mont.), Ballycarry, Larne Lough (Miss Fisher) ; *Hiatella gallicana* (Lam.), juveniles from Dunseverick, Co. Antrim (R. J. Welch), adults from Green-island (Miss Fisher) ; *Cardium scabrum* Phil., Ballycarry, Larne Lough (Miss Fisher). Also *Chlamys varia* (L.) and *Chlamys nivea* (Macgillivray), from various localities.

There was a Special Exhibit of "Marine Mollusca illustrating attacks by enemies".

642nd Meeting (Joint Meeting with the Yorkshire and North Staffs Branches), held at the Manchester Museum, 3rd April, 1937.

The President (Lieut.-Col. A. J. Peile) in the chair.

Present : Mrs. and Miss Morehouse, Mr. and Mrs. G. C. Spence, Mr. and Mrs. J. C. North, Messrs. W. Thurgood, C. H. Moore, H. Emmett, B. Bryan, and Drs. J. W. Jackson and L. C. D. Hermitte.

Election of New Member.

B. S. Vesey-Fitzgerald.

Papers Read.

"Obituary Notice : Robert John Welch," by J. Wilfrid Jackson.

"Obituary Notice : John Davy Dean," by Colin Matheson.

Exhibits.

The Special Exhibit was *Gulella*, and the President, who takes a special interest in this group, exhibited a fine series of some 166 species and varieties ; also the radula of *Gulella ugandensis* Sm. He gave a most interesting and informative talk on the group. Exhibits in the same group

were made by Mr. G. C. Spence and the Manchester Museum. Other exhibits were :—

By Mr. G. C. Spence : Land Operculates. Also a water-colour drawing of Malham Cove by the late J. Davy Dean.

By Mrs. Morehouse : *Truncatella stimpsonii* Stearns, Malaga Cove, California, *T. pulchella* Pfr., and *T. caribæensis* Sow., *Coxiella badgerensis* Johnston, and *C. confusa* Johnston, Corrong, S. Australia, *Cypræa subviridis* Reeve, S. Australia, *Trivia oryza* Lam., Philippines, *T. globosa* K., Port Blair, *Pustularia nucleus* L., and *P. cicercula* L., Oshima, Japan, *Erato vitellina* Hinds, La Jolla, California.

By Mr. B. Bryan : *Lymnæa pereger* (Müll.), Longton, Staffs. Also other species of *Lymnæa* from the same locality, *Clausilia rugosa*, with curious mouth, and *Vertigo antivertigo* from Staffs.

By Mr. C. H. Moore : Selection from the John Brazier Collection (Conchological Society's Cabinet) recently mounted in glass-topped boxes.

By Dr. J. Wilfrid Jackson : British Marine shells from Argyllshire (coll. Rev. R. W. Nevill), including *Littorina littorea* (L.), *L. saxatilis* (Oliv.), *L. littoralis* (L.), *Calliostoma ziziphinum conuloide* (Lam.), *Patella vulgata* L., *Cyprina islandica* (L.), *Cardium edule* L. (large examples), *Chlamys opercularis* (L.), and *Chlamys nivea* (Macg.), all from Appin ; also *Buccinum undatum* L., *Glycymeris glycymeris* (L.), *Mytilus edulis* L., *Modiolus modiolus* (L.), *Pecten maximus* (L.), *Phacoides borealis* (L.), *Cardium crassum* Gmel., *Dosinia exoleta* (L.) (51 × 52 mm.), *Venus casina* L., *Venus striatula* (da Costa), *Paphia pullastra* (Mont.), *Paphia decussata* (L.) (51 × 65 and 48 × 63.5 mm.), *Tellina crassa* Penn. (40 × 48.5 mm.), *Scrobicularia plana* (da Costa), *Gari depressa* (Penn.) (39 × 66 and 35 × 61 mm.), *Pharus legumen* (L.), *Ensis ensis* (L.), *Ensis siliqua* (L.), *Solen marginatus* Mont., *Lutraria lutraria* (L.), *Mya arenaria* L., all from Loch Moidart. Also, *Chlamys varia* (L.), very large examples from the Firth of Clyde (coll. F. G. Pearcey), and *Ensis siliqua* (L.), large examples (36 × 233 mm.) from Rams Bay, Cumbrae (coll. F. G. Pearcey).

643rd Meeting, held at the Manchester Museum, 8th May, 1937.

Mr. G. C. Spence in the chair.

Resignation.

P. Vlasto.

Papers Read.

"The Genus *Xymorus* Gebler," by H. A. Rehder.

"Investigation of the Scallop Fishery off Digby," by J. A. Stevenson.

Exhibits.

By Mr. G. C. Spence : Achatinas showing disparity in size and shape in the same species. Sketches of living *Ligatella insularis* Pfr., from East London.

By Mrs. Morehouse : Series of Pteropods including *H. tridentata* Forsk. from the stomach of a hawk-billed turtle.

By Mr. C. H. Moore : *Bulimus (Borus) ovatus* Müller, very large and heavy compared with normal specimens. *Epiphragmophora fidelis* Gray, very high-spined specimen and normal examples.

INDEX

	page		page
<i>Acanthinula aculeata</i> new to		<i>Armenica</i> (<i>Creniclavus</i>) <i>euprepes</i>	
Easternness	28	sp. nov.	253
— — — Somerset N.	187	<i>Ashfordia granulata</i> new to	
Accounts 30, 127, 220, 306		Easternness	188
<i>Achatina fulica</i> (Fér.) in the		— — — Kerry S.	189
Netherlands E. Indies	43	<i>Assimineia grayana</i> new to	
<i>Acme lineata</i> new to Devon S.	314	Norf. E. and W.	187
— — — Kildare	28	<i>Azeca tridens</i> new to Kent E.	187
— — — Northumberland N.	157	— — — Northumberland N.	157
Adams, L. E., Giant Form of		Barnard, Dr. K. H., Cephalo-	
<i>P. corneus</i>	57	pods from the C.G.H.	44
— — — <i>Helicella acuta</i> inland	165	— — — New <i>Gomiodoris</i> from S.	
— — — Infant Mortality of <i>Mol-</i>		Africa	2
lusca	341	Beachy Head, <i>Hydrobia</i>	
Address, Changes of 98, 194, 290		<i>jenkinsi</i> on	290
<i>Aglaja iwasai</i> sp. nov.	258	Bequaert, J., and W. J. Clench,	
<i>Agriolimax lævis</i> new to Car-		Studies of African L. and	
marthen	314	F.W. Moll.— <i>Edentulina</i> ,	
— — — Ebudes N.	28	with Descriptions of New	
— — — Glos. E. and W.	314	Spp.	204
— — — Hebrides	28	— — — Studies of African L.	
— — — Roxburgh	188	and F.W. Moll.— <i>Gonaxis</i> ,	
<i>Albinaria greeni</i> sp. nov.	164	with Description of a New	
<i>Alderia modesta</i> (Lovén)	16	Sp.	263
Allen, C., Self-fertilization	126	<i>Berthellina engeli</i> g. and sp.	
<i>Amnicola taylori</i> Smith in		nov.	198
Scotland	55	Biggs, H. E. J., Mollusca of	
<i>Amphipeplea glutinosa</i> new to		the Iranian Plateau	342
Donegal E.	189	— — — New <i>Clausilia</i> from	
— — — Kildare	189	Asia Minor	253
Amroth, Collecting at	76	— — — New Var. of <i>M. loriæ</i>	
<i>Ancylus fluviatilis</i> new to Mayo		Issel	60
E.	314	Bionomics of a Nudibranch,	
— <i>lacustris</i> new to Berwick	28	Dr. Pelsener	54
— — — Stirling	188	Birdlip Woods, Fauna of	85
<i>Anodonta</i> in E. Kent, J. E.		<i>Bithynia leachii</i> new to Mont-	
Cooper	290	gomery	314
— <i>anatina</i> new to Cornwall E.	27	— — — in Scotland.	55
— — — Dorset	27	— <i>tentaculata</i> new to North-	
— — — Fife	188	umberland N.	157
— — — Linlithgow	314	Bligh Collection	154
— — — Montgomery	188	Bloomer, H. H., On Distin-	
— <i>cygnea</i> , Shell of, distin-		guishing the Shell of <i>A.</i>	
guished from that of <i>A.</i>		<i>cygnea</i> from that of <i>A.</i>	
<i>anatina</i>	321	<i>anatina</i>	321
<i>Aplexa hypnorum</i> new to		Bowell, Ernest W. (1872–	
Hebrides	28	1935)	101
<i>Archidoris britannica</i> (John-		Boycott, A. E., Colonization	
ston)	255	of Land Shells	224
— <i>flammea</i> (A. & H.)	362	— — — Ernest W. Bowell (1872–	
<i>Arion circumscriptus</i> new to		1935)	101
Mayo E.	314	— — — Habits of young <i>H.</i>	
— <i>minimus</i> new to Glos. E.	187	<i>pomatia</i>	224
— — — Roxburgh	188	— — — <i>N. fluviatilis</i> in Orkney	199
— <i>subfuscus</i> new to Mayo E.	314	British Moll., Names of 9, 51	
— — — Sutherland W.	188	— — — Type Localities of	176

	page		page
<i>Cæcilioides acicula</i> new to		Cooper, J. E., <i>Anodonta</i> in	
Devon S.	187	E. Kent	290
— — — Middlesex	27	— — Oldhaven and Thanet	
— — — Warwick	187	Sand Moll. of Herne Bay	4
<i>Carychium minimum</i> new to		<i>Crepidula fornicata</i> (L.)	163
Elgin	28	<i>Cypræa vinosa</i> Gm. in a Saxon	
— — — Ross E.	188	Grave	46
— — — Sutherland W.	188	Cypræidæ, Monstrosities in	222
<i>Cecilioides acicula</i> , Abundance		— of Hawaii	320
of	152	Cyprus, New <i>Albinaria</i> from	164
<i>Cepæa nemoralis</i> , Early Occur-		Dalgliesh, J. G., <i>Macra stul-</i>	
rence of	255	<i>torum</i> L. and <i>Pinnotheres</i>	81
Cephalopods from S. Africa	44	Dean, J. D., Conchological	
— of the Yorkshire Coast		Cabinets of the Last Cen-	
	102, 129, 257	tury	225, 319
Cheatum, E. P., <i>Rumina decol-</i>		— — Type Localities of Brit.	
<i>lata</i> (L.) in the New World	84	Moll.	176
Cheshire, Whitehead's Early		— — Obituary Notice	319, 338
Records for	275	Dillwyn's Diary	154
Clarke, W. J., and J. A.		Dimorphism in <i>Zonitoides</i> ,	
Stevenson, Yorkshire		Genital	33
Cephalopods	129, 257	Disappearance of <i>L. peregra</i>	
<i>Clausilia biplicata</i> new to		from Friston Pond	217
Herts	187	— <i>Canth. exasperatus</i> from	
— <i>cravenensis</i> new to North-		Porthcurnow	315
umberland S.	28	<i>Doridigitata sticta</i> I. and O.D.,	
— <i>dubia</i> Drp.	339	a Brit. species	10
— <i>laminata</i> new to Essex S.	187	Dredging	305
— <i>rugosa</i> new to Ross E.	188	Durham, Non-Marine Depo-	
Clench, W. J., New <i>Hyridella</i>		sits in	87
from Australia	89	<i>Eastonia rugosa</i> in Portugal	162
— — and R. A. McLean,		<i>Edentulina</i> Pfr., Notes on	204
Description of a new <i>Macro-</i>		— <i>ulugurensis</i> n. sp.	213
<i>callista</i>	201	— <i>usambarensis</i> n. sp.	215
— — see also under		Editorial Notes 92, 98, 154, 286, ...	319
J. Bequaert		<i>Ena obscura</i> new to Clyde Is.. . . .	28
Coates, Henry	262	— — — Easternness	28
<i>Cochlicella barbara</i> new to		Enemies of Brit. L. and F.W.	
Kent W.	156	Moll.	351
Cockerton (Durham), Depo-		Engel's Paper on English	
sits at	88	Pleurobranchidæ	195
Collections of Last Century		<i>Euconulus fulvus</i> new to	
	225, 319	Hebrides	189
Colonization of Land Shells	224	Eulimidæ, Genera of the	13
<i>Columella edentula</i> new to		<i>Eulota fruticum</i> new to Kent	
Aberdeen S.	188	W.	187
— — — Cornwall W.	314	Euphallic Condition	36
— — — Dorset	187	<i>Euspira</i> Ag. vice <i>Lunatia</i> Gray	14
— — — Ebudes Mid	314	Extinct Marine Moll. at Port-	
— — — Kent W.	187	stewart	117
— — — Pembroke	156	<i>Facelina drummondi</i> (A. & H.)	
— — — Ross E.	188	Habitat of	24
Conchological Cabinets of last		Falmouth	74
Century	225, 319	Fisher, Miss N., <i>Archidoris</i>	
<i>Conchologist</i> , two editions of		<i>britannica</i> (Johnston).	255
vol. i	192	— — and Dr. Jackson, Early	
Cone, Fatal Sting by a	166	Records of Lancs and Chesh.	
<i>Conus hopwoodi</i> nom. nov.	254	Moll. by J. W. Whitehead	273
— Mechanism of the Radula	301	— — Habitat of <i>Facelina drum-</i>	
Cooke, Rev. Dr. A. H.	77	<i>mondi</i> (A. and H.)	24

	page		page
Fisher, Miss N., Locally Extinct Marine Moll. at Portstewart	117	Hemiphallic Condition . . .	36
— — Marine Moll. of Magiligan	168	Herne Bay, Geology of . . .	4
— — <i>Monodonta lineata</i> (da C.) in N. Wales	224	Hirase, Shintaro, New <i>Aglaja</i> from Japan	258
— — Notes on Brit. Opisthobranchs, I. Ecology of <i>Arch. flammea</i> (A. & H.)	362	Holocene Deposit in Co. Down	91
— — Preference of <i>Patina pelucida</i> (L.) for <i>L. digitata</i>	83	Humphrey, G., Letter from <i>Hyalinia alliaria</i> new to King's Co.	332
— — see also under Tomlin, J. R. le B.		— <i>cellaria</i> new to Sutherland W.	189
Flood-Débris in Poland, A. Jankowski	152	— <i>crystallina</i> new to Ross E.	188
Forbes and Hanley's Brit. Moll., Dates of	150	— — — Shetland	189
Fowler, W., Dredging in Loch Linnhe	305	— — — Sutherland W.	188
Frost, Moll. Destroyed by <i>Galeodea</i> Link vice <i>Cassidaria</i> Lam.	9	— <i>nitidula</i> new to Orkney	189
Gardiner, A. P., Engel's Paper on English Pleurobranchidæ	195	— — — Sutherland W.	188
— — The Littoral Zone	65	— <i>pura</i> new to Ross E.	188
Gayner, Dr. J. S., Obit. Notice, H. Sowden	291	— <i>radiatula</i> new to Mayo E.	314
Giant Form of <i>Plan. corneus</i>	57	— — — Sutherland E.	188
<i>Gonaxis</i> Taylor, Notes on	263	— <i>rogersi</i> new to Worcester	187
— (<i>Macrogonaxis</i>) <i>loveridgei</i> sp. nov.	271	<i>Hydrobia jenkinsi</i> on Beachy Head	290
<i>Goniodoris ovata</i> n. sp.	2	— <i>taylori</i> Smith and <i>steinii</i> Mts.	320
Grensted, L. W., Fauna of Birdlip Woods	85	<i>Hygromia fusca</i> new to Kent W.	187
<i>Helicella acuta</i>	165	— <i>hispida</i> new to Hebrides	28
— <i>caperata</i> new to Ayr	188	— <i>striolata</i> new to Berwick	28
— — — Berwick	28	<i>Hyridella bardwelli</i> sp. nov.	89
— — — Ebudes N.	314	Infant Mortality of Mollusca	341
— — — Hebrides	28	Iranian Plateau, Moll. of	342
— — — Kerry S.	189	Iredale T., Fatal Sting by a Cone	166
— — — Monmouth	314	Jackson, Dr. J. W., <i>Cypræa vinosa</i> Gm. in a Saxon grave in Somerset	46
— — — Roxburgh	188	— — Collection of Brit. Moll.	286
— — — Stirling	188	— — see also under Fisher, N.	
— — — Tipperary N. and S.	189	— — Letter from G. Humphrey to W. Swainson	332
— — — Waterford	189	— — Obit. Notice—R. J. Welch	329
— — Unusual Habitat of <i>heripensis</i> new to Durham	369	Jankowski, A., Flood-Débris in Poland	152
— — — I. of Wight	189	Jersey, Collecting in	72
— — — Northumberland N.	188	Jutting, Miss Tera van B., <i>Achatina fulica</i> (Fér.) in the Netherlands E. Indies	43
— — — Roscommon	189	Kennard, A. S., and B. R. Lucas, Non-Marine Deposits in Yorks and Durham	86
— <i>itala</i> new to Devon S.	27	Kevan, D. K., <i>Limapontia depressa</i> (A. and H.) var. nov. in Scotland	16
— <i>virgata</i> new to Ebudes N.	314	— — <i>L. pereger</i> var. <i>maritima</i> Jeff. at Gullane Point, Firth of Forth	59
<i>Helix arbustorum</i> new to Easternness	28	— — <i>Vallonia costata</i> monstr. from E. Lothian	82
— — — Essex S.	187	Kirby Fleetham, Deposits at	86
— <i>aspersa</i> , Reputed Smooth Variety of	48		
— <i>minuscule</i> Binney	281		
— <i>nemoralis</i> new to Easternness	188		
— <i>pomatia</i> , Habits of young	224		

	page		page
Lancashire, Whitehead's Early		<i>Milax gagates</i> new to Ebudes N.	314
Records for	275	— — — Hebrides	189
<i>Latiaxis</i> , Catalogue of Recent	180	— — — Pembroke	28
Lawson, A. K., see under		— — — Yorks M.W.	188
Wild, S. V.		— <i>gracilis</i> new to Brecon	156
Letter from G. Humphrey to		— — — Herts	27
W. Swainson	332	— — — Pembroke	28
<i>Limapontia depressa</i> (A. & H.)		— — — Somerset N.	187
var. <i>pellucida</i> Kevan	18	— — — Wilts N.	314
— — — Bionomics of	54	— <i>sowerbii</i> new to Brecon	156
— <i>nigra</i> Bate	16	— — — Dorset	156
<i>Limax arborum</i> new to Lanark	188	— — — Montgomery	314
— <i>cinereoniger</i> new to Glos. E.	187	— — — Oxford	187
— — — Monmouth	314	— — — Suffolk W.	27
— <i>maximus</i> new to Hebrides.	189	<i>Monacha iranica</i> n. sp.	343
— <i>tenellus</i> new to Glos. E.	187	<i>Monodonta lineata</i> (da C.) in	
— — — Monmouth	314	N. Wales	224
<i>Limnæa aurieularia acuta</i> new		Monstrosities : Cypræidæ	222
to Perth W.	188	— <i>C. nemoralis</i>	286
— <i>glabra</i> new to Essex S.	187	— <i>L. peregra</i> va. <i>maritima</i>	60
— — — Pembroke	188	— <i>Vallonia costata</i>	82
— — — Perth W.	314	— — <i>pulchella</i> (sinistral)	152
— — — Suffolk E.	187	Moore, C. H., Slug and Beetle	85
— <i>involuta</i> new to Sutherland		— — <i>N. lapillus</i> L., at Knott	
W.	161, 188	End	361
— <i>palustris</i> new to Aberdeen		Moses, R. H., <i>Claus. dubia</i>	
S.	188	Drap.	339
— — — Donegal E.	189	Mullet, Snails of the	146
— — — Easterness	188	Names of Brit. Mollusca II	9
— — — Galway N.E.	189	— — — III	51
— — — Hebrides	28	<i>Neptunea</i> versus <i>Chrysodomus</i>	15
— <i>peregra</i> var. <i>maritima</i> Jeff.		<i>Neritina fluviatilis</i> in Orkney	
in Firth of Forth	59		199, 273
— <i>stagnalis</i> new to Denbigh	188	— — new to Cheshire	156
— <i>truncatula</i> new to Easter-		— — — Kent W.	187
ness	28	— — — Kildare	189
— — — Westerness	28	— — — Mayo E.	314
Littoral Zone, The, A. P.		<i>Nucella lapillus</i> L., Coloura-	
Gardiner	65	tion of	61
Lloyd James, W. F., Early		— — at Knott End	361
Occurrence of <i>C. nemoralis</i>	255	Oban, Collecting at	73
Loch Linnhe, Dredging in	305	Obituary Notices :—	
Lucas, B. R., see under Ken-		E. W. Bowell	98, 101
nard, A. S.		H. Coates	262
<i>Lucina odontotis</i> , new species	58, 93	Rev. Dr. A. H. Cooke	77, 92
MacDonald, R., Distribution		P. Dautzenberg	154
of <i>P. corneus</i> in Ulster	194	J. D. Dean	319, 338
— — New Holocene Deposit		L. Faustino	286
in Co. Down	91	Dr. M. Grabham	154
<i>Macrocallista bardwelli</i> n. sp..	202	J. A. Grieg	286
— <i>nioba</i> nom. nov.	201	Mrs. Longstaff (<i>née</i> Donald)	98
Magilligan, Marine Moll. of.	168	Dr. R. F. Scharff	79, 92
<i>Margaritana margaritifera</i> new		H. Sowden	291
to Queen's Co.	157	R. J. Welch	286, 329
Matheson, C., Obit. Notice—		W. J. Wintle	92
J. D. Dean	338	<i>Ocenebra</i> Leach	14
McLean, R. A., see under		Officers and Council, List of	
Clench, W. J.			1, 97, 193, 289
<i>Melanopsis doriæ</i> Issel var.		Oldham, C., <i>L. involuta</i> in	
<i>nigra</i> nov.	60	W. Sutherland	161

	page		page
Oldham, C., Notes on the Snails of the Mullet . . .	146	<i>Pisidium amnicum</i> new to Berwick . . .	157
— — <i>Pisid. vincentianum</i> in Kentish Pleistocene . . .	167	— — — Edinburgh . . .	188
— — Reputed smooth-shelled var. of <i>H. aspersa</i> . . .	48	— — — Lanark . . .	188
— — Unusual Habitat of <i>H.</i> <i>caperata</i> . . .	369	— <i>cinereum</i> new to Ebudes Mid . . .	314
Oldhaven Beds . . .	4	— — — Kirkcudbright . . .	28
Orkney Mollusca 199, 273, 283, 341		— — — Wigtown . . .	28
Oxney Fields, Deposits at . . .	87	— <i>conventus</i> new to Easternness . . .	188
<i>Paludestrina jenkinsi</i> new to Hebrides . . .	28	— <i>henslowanum</i> new to Dum- fries . . .	28
— — — Kincardine . . .	188	— — — Fife . . .	314
— — — Montgomery . . .	188	— — — Haddington . . .	157
— — — Wilts N. . .	314	— — — Perth W. . .	188
— — — Yorks N.W. . .	156	— <i>hibernicum</i> new to Elgin . . .	28
— <i>stagnalis</i> new to Durham . . .	157	— — — Hebrides . . .	189
— — — Easternness . . .	188	— — — Kirkcudbright . . .	28
— — — Ebudes N. . .	28	— — — Perth W. . .	188
— — — Hebrides . . .	28	— — — Radnor . . .	314
— <i>ventrosa</i> new to Denbigh . . .	188	— — — Ross W. . .	188
— — — Down . . .	189	— — — Roxburgh . . .	188
— — — Hebrides . . .	28	— — — Wigtown . . .	28
— — — Norfolk E. . .	187	— <i>lilljeborgi</i> new to Ayr . . .	188
— — — Suffolk E. . .	187	— — — Berwick . . .	157
<i>Paludina vivipara</i> new to Den- bigh . . .	314	— — — Elgin . . .	28
<i>Pandora</i> and <i>Calopodium</i> . . .	52	— — — Hebrides . . .	28
<i>Patelloida vice Acmaea</i> . . .	11	— — — Kirkcudbright . . .	28
<i>Patina pellucida</i> L. on <i>Lamin-</i> <i>aria</i> . . .	83	— — — Roxburgh . . .	188
<i>Pecten</i> of Osbeck . . .	51	— — — Wigtown . . .	28
Peile, A. J., <i>Helix minuscula</i> Binney . . .	281	— <i>miliun</i> new to Ayr . . .	188
— — Some Tristram Types . . .	254	— — — Berwick . . .	157
— — Some Radula Problems . . .	292	— — — Dumfries . . .	28
Pelseneer, Dr. Paul, Bionomics of a Brackish-Water Nudi- branch, <i>Limapontia depressa</i> . . .	54	— — — Hebrides . . .	189
Pendine, Collecting at . . .	76	— — — Kent W. . .	156
Phillips, R. A., <i>Vert. genesii</i> Gredler in Central Ireland . . .	142	— — — Kirkcudbright . . .	28
<i>Physa fontinalis</i> new to Aber- deen S. . .	188	— — — Roxburgh . . .	188
— — — Mayo E. . .	314	— — — Salop . . .	188
— <i>heterostropha</i> new to Devon S. . .	156	— — — Selkirk . . .	188
— — — Salop . . .	314	— — — Wigtown . . .	28
— — — Yorks S.W. . .	28	— <i>nitidum</i> new to Ayr . . .	188
<i>Phytia myosotis</i> new to Car- marthen . . .	314	— — — Berwick . . .	157
— — — Devon S. (var. <i>ringens</i>) . . .	27	— — — Elgin . . .	28
— — — I. of Wight . . .	187	— — — Hebrides . . .	28
— — — Kilkenny . . .	189	— — — Kirkcudbright . . .	28
— — — Kirkcudbright . . .	314	— — — Ross W. . .	188
— — — Ross E. . .	188	— — — Roxburgh . . .	188
— — — Waterford . . .	189	— — — Selkirk . . .	188
<i>Pinnotheres pisum</i> in <i>M. stul-</i> <i>torum</i> . . .	81	— — — Wigtown . . .	28
		— <i>obtusale</i> new to Berwick . . .	157
		— — — Dumfries . . .	28
		— — — Ebudes Mid . . .	314
		— — — Elgin . . .	28
		— — — Kirkcudbright . . .	28
		— — — Wigtown . . .	28
		— <i>personatum</i> new to Cam- bridge . . .	27
		— — — Dumfries . . .	28
		— — — Easternness . . .	28
		— — — Ross E. . .	314
		— — — Wigtown . . .	28
		— — — Wilts N. . .	314

	page		page
<i>Pisidium pulchellum</i> new to		Pleurobranchidæ, English	195
Dumfries	28	Ponds on Eastbourne Downs,	
— — — Durham	188	Moll. of	130, 217, 290, 308
— — — Kirkcudbright	188	Portstewart, Locally Extinct	
— — — Mayo E.	314	Marine Moll. at	117
— — — Northants	187	Portuguese Mollusca	162
— — — Northumb. N. and S.	188	<i>Potadoma graptoconus</i> , P & B.	340
— — — Perth E.	188	Proceedings	
— — — Radnor	156	25, 94, 155, 184, 218, 256, 288, 310,	
— — — Salop	188	370	
— — — Selkirk	188	<i>Pseudanodonta</i> new to Cheshire	314
— — — Wigtown	28	— — — Salop	28
— <i>subtruncatum</i> new to Ayr	188	<i>Punctum pygmæum</i> new to	
— — — Berwick	157	Elgin	28
— — — Dumfries	28	— — — Norfolk W.	187
— — — Hebrides	189	— — — Ross E.	188
— — — Kirkcudbright	28	— — — Selkirk	188
— — — Roxburgh	188	<i>Pupa anglica</i> new to Easter-	
— — — Wigtown	28	ness	188
— <i>vincentianum</i> in Kentish		— — — Ebudes S.	188
Pleistocene	167	— — — Northumberland N.	188
<i>Planorbis albus</i> new to Donegal		— <i>marginata</i> new to Hebrides	28
E.	189	— — — Orkney	189
— — — Ebudes N.	314	— <i>secale</i> new to Kent E.	187
— <i>carinatus</i> new to Donegal E.	189	— <i>umbilicata</i> new to Easterness	28
— — — Kent W.	187	<i>Pyramidula rupestris</i> new to	
— — — Salop	188	Kent W.	187
— <i>complanatus</i> new to Car-		Quick, Dr. H. E., <i>Isidorella</i>	
marthen	314	<i>pyramidata</i> (Sow.), A cor-	
— — — Fife	188	rection	50
— — — Selkirk	188	Radula Problems, Some, A. J.	
— <i>contortus</i> new to Galway S.E.	189	Peile	292
— — — Montgomery	188	Rehder, H. A., The Genus	
— — — Northumberland N.	157	<i>Xymorus</i>	370
— <i>corneus</i> in Down	81	Rendall, R., <i>Simnia patula</i>	
— — in Ulster	194	(Penn.) in Orkney	283
— — new to Devon S.	187	Reputed Smooth-shelled	
— — — Montgomery	188	Variety of <i>H. aspersa</i> .	48
— — — Salop	314	Réunion Amicale at Paris	154
— — Giant Form	57	Ritchie, J., H. Coates	262
— <i>dilatatus</i> new to Ebudes N.	314	<i>Rumina decollata</i> (L.) in the	
— <i>fontanus</i> new to Edinburgh	314	New World	84
— — — Kirkcudbright	314	Salcombe Estuary	67
— — — Selkirk	188	Salisbury, A. E., New Species	
— <i>glaber</i> new to Dorset	314	of <i>Lucina</i>	58
— — — Orkney	189	<i>Scala</i> Brug.	53
— — — Pembroke	188	Scharff, Dr. R. F.	79
— — — Radnor	314	Schilder, Dr. F. A., Monstro-	
— — — Stafford	188	sities in Cypræidæ	222
— — — Westmeath	189	Schlesch, H., <i>Crepidula formi-</i>	
— <i>nautilus</i> new to Berwick	28	<i>cata</i> (L.) in Schleswig and	
— — — Ebudes Mid	314	Denmark	163
— — — Northumberland N.	157	Scotland, Species new to	55, 314
— — — Sutherland W.	188	<i>Segmentina nitida</i> new to	
— <i>spirorbis</i> new to Berwick	28	Essex S.	314
— — — Easterness	188	Self-fertilization	126
— — — Fermanagh	189	Shell Disease	92, 99
— — — Hebrides	189	Shrubsole, G., Apparent Dis-	
— <i>vortex</i> new to Ebudes Mid	314	appearance of <i>L. peregra</i>	
— — — Kirkcudbright	188	from Friston Pond	217

	page		page
Shrubsole, G., <i>H. jenkinsi</i> on		<i>Trigonodesma vice Fossularca</i> .	9
Beachy Head	290	Tristram Types	254
— — Moll. of the Ponds on		<i>Truncatellina cylindrica</i> new to	
Eastbourne Downs	130, 308	Durham	188
<i>Simnia patula</i> (Pennant) in		— — — Norfolk W.	187
Orkney	283	Ulster, <i>Plan. corneus</i> in	194
Slug and Beetle	85, 165	<i>Unio tumidus</i> new to Denbigh	314
Sowden, Harry	291	<i>Vallonia costata</i> new to	
Spence, G. C., Notes on		Hebrides	189
<i>Potadoma graptoconus</i> P. & B.	340	— — — monstr.	82
<i>Sphærium ovale</i> new to Mid-		— <i>excentrica</i> new to Durham	157
dlesex	187	— — — Fife	188
— <i>rivicola</i> new to Devon S.	187	— — — Kincardine	188
— — — Essex S.	187	— — — Monmouth	314
— — — Hereford	187	— — — Northumberland S.	157
— — — Sussex W.	156	— — — Peebles	188
Stevenson, J. A., The Cepha-		— — — Sutherland W.	188
lopods of the Yorks Coast	102	— <i>pulchella</i> new to Berwick	
— — see also under Clarke, W. J.			188, 314
Stubbs, A. G., <i>Testacella</i>		— — — Durham	157
eating <i>Milax</i>	149	— — — Haddington	28
<i>Succinea arenaria</i> new to Tip-		— — — Mayo W.	28
perary N.	157	— — — Norfolk E.	187
— <i>pfeifferi</i> new to Aberdeen S.	188	— — — Northumberland N.	157
— — — Donegal E.	189	<i>Valvata cristata</i> new to Ber-	
— — — Easterness	28	wick	28
— — — Ebudes N.	314	— — — Monmouth	314
— — — Hebrides	28	— — — Perth W.	188
— — — Kerry S.	189	— — — Selkirk	188
— — — Lanark	188	— <i>piscinalis</i> new to Donegal	
— — — Ross E.	188	E.	189
— — — Roxburgh	188	— — — Northumberland N.	188
— — — Sutherland W.	188	— — — Selkirk	188
— <i>putris</i> new to Northumber-		— — — Sutherland W.	188
land N.	188	<i>Vertigo antivertigo</i> new to	
<i>Syncera</i> , status of	12	Durham	188
<i>Testacella haliotidea</i> new to		— — — Easterness	188
Durham	314	— — — Hebrides	28
— <i>maugei</i> new to Sussex W.	156	— — — Kent W.	187
— in Sussex	145	— — — Kildare	189
— eating <i>Milax</i>	149	— — — Perth W.	188
Thanet Sand	4	— — — Selkirk	188
Tomlin, J. R. le B., Catalogue		— — — Sutherland W.	188
of Recent <i>Latiaxis</i>	180	— <i>genesii</i> new to Galway N.E.	
— — <i>Conus gracilis</i> Sow.	254	and S.E.	189
— — and N. Fisher, Dates of		— — — Queen's Co.	189
Publication of Forbes and		— — — Tipperary N.	189
Hanley's <i>Hist. Brit. Moll.</i>	150	— <i>lilljeborgi</i> new to Aberdeen	
— — Dr. R. F. Scharff	79	S.	188
— — Moll. Destroyed by Frost	273	— — — Clare	189
— — New <i>Albinaria</i> from		— — — Easterness	188
Cyprus	164	— — — Ebudes N.	188
— — Orkney L. and F. W.,		— — — Galway S.E.	189
Shells	341	— — — Hebrides	28
— — Rev. Dr. A. H. Cooke	77	— — — Roxburgh	188
— — Slug and Beetle	165	— <i>moulinsiana</i> new to Clare	189
— — <i>Testacella</i> in Sussex	145	— — — Tipperary N.	189
— — and N. Fisher, Two		— — — Wexford	189
Editions of vol. i of <i>The</i>		— <i>pusilla</i> new to Essex S.	187
<i>Conchologist</i>	192	— — — Kincardine	188

	page		page
<i>Vertigo pygmæa</i> new to Elgin	28	Wild, S. V., and A. K. Lawson,	
— — — Essex N.	187	Enemies of the L. and F.W.	
— — — Hebrides	28	Moll. of the Brit. Isles	351
— — — Ross E.	188	Wilkins, G. L., Colouration of	
— — — Sutherland W.	188	<i>N. lapillus</i> L.	61
— <i>substriata</i> new to Berwick	28	Winckworth, H. C. and R.,	
— — — Easternness	28	<i>Eastonia rugosa</i> Helb. and	
— — — Elgin	28	other Portuguese Moll.	162
— — — Hants S.	187	— R., Names of Brit. Moll. II	9
— — — Kent W.	187	— — — III	51
— — — Lanark	188	<i>Xymorus</i> Gebler, The Genus	370
— — — Northumberland S.	157	Yorks (N. Riding), Non-	
— — — Ross E.	188	Marine Deposits in	86
— — — Selkirk	188	— Coast, Cephalopods of the	
— — — Sussex W.	187	102, 129, 257	
— — — Sutherland W.	188	<i>Zonitoides excavatus</i> new to	
<i>Vitrina major</i> new to Mon-		Carmarthen	314
mouth	314	— — — Easternness	188
Waterston, R., Occurrence of		— — — Ebudes N.	314
<i>Amnicola taylori</i> and <i>B.</i>		— — — Kent W.	27
<i>leachii</i> in Scotland	55	— — — Monmouth	314
Watson, Hugh, Genital Dimor-		— <i>nitidus</i> new to Carmarthen	314
phism in <i>Zonitoides</i>	33	— — — Haddington	28
Welch, R. J., <i>Plan. corneus</i> in		— — — Montgomery	314
co. Down	81	— — — Perth Mid	28
— — Obit. Notice	286, 329	— — — Ross E.	188
Whitehead's Early Records for		— Genital Dimorphism in, H.	
Lancs. and Cheshire	275	Watson	33

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